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Correspondence, views and opinions on all topics within the province of this journal are cordially invited from any part of the world. We will thank readers to forward to us—**promptly** as they occur—**Items of News,** or information relating to any application of Electricity, also marked copies of their local papers containing anything likely to interest electricians. Anonymous communications cannot be noticed, nor can rejected manuscript be returned, unless accompanied by the necessary postage when received.

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VOL. XIV. NEW YORK, DEC. 14, 1889. No. 24.

The Canadian Cable.

IT is reported from England that the plans and arrangements for the proposed cable from Canada to Ireland have been perfected and that the work will begin early next year. The main stretch will be only 1,900 miles in length, and various advantages are claimed for the northerly route chosen. It is said that Canadian business messages already number 800 a day. That is not an excessive quantity, however, and the company is likely to need other sources of traffic and income.

Motor Construction.

THE theory of electric motor construction during the last few years may be said to have followed very closely that of the dynamo, viz., that the field shall be a strong magnet while the armature is, relatively, a weak magnet. It is true that Professors Ayrton and Perry have promulgated an opposite theory, but the results of practice do not seem to have borne out their ideas, while abundant proofs can be cited in support of present practice. In considering this question of the relative magnetic strengths of field and armature, Mr. Nikola Tesla arrives at the ingenious conclusion that the best results are obtained when both are equal in this respect. The reasoning followed by Mr. Tesla is very clearly stated in another column, and appears to be conclusive. It has been demonstrated, we may add, by actual practice. The law pointed out by Mr. Tesla refers more particularly to economy in weight of material for a given output, for it is evident that machines differing considerably in weight might, at the same output, have equally high efficiencies.

Electric Motor Power.

A PROMINENT wholesale house in Chicago is employing a motor to drive a special device used in sewing carpets, and so perfectly is the work accomplished that a young girl can sew nine yards of carpeting more uniformly and in less time than one yard can be sewn by hand. Some labor agitators will probably use this device to prove how easily eight girls can be thrown out of a position, without stopping to consider that the universal adoption of a device similar to the above by all the large house-furnishing companies will result in benefiting thousands of carpet buyers through reducing the cost of making up fully one half. In another large Western factory a motor is coupled in a circuit so arranged that when a thin pane of glass in a wooden case (a number of which are placed at prominent points about the rooms where girls are employed) is broken, a spring is released that closes the circuit, and thus shuts off the passage of steam to the engine, instantly stopping the latter. If a girl sees her companion's hair or dress becoming entangled in the belting or shafting, it requires but a moment's effort to break the glass in the nearest box and thus release the poor creature from further danger, irrespective of the presence of the engineer at his engine, and saving the expense formerly incurred in employing an assistant to remain constantly at the engine.

How Not to Run Stations.

A SLIGHT railway accident recently compelled an electrical engineer to remain over night in a small town, and to kill time he visited the local lighting station, where he found a mere lad in charge. Entering into conversation, he learned that the plant had not turned out as profitable as desired, and that the stockholders were growling about the prospects. Inspection of the circuits showed that while they were in excellent order, with the exception of a loosened connection or two, the lights were not giving out their normal brilliancy. Returning to the station, he located the trouble in the boiler room, where he found the grate bars covered with a mass of hardened clinkers, through which but little air could percolate, and which required the most severe exertion to remove, while further examination showed that neither the flues nor the tubes had been properly cleaned for months. All this was remedied the following day; an abundance of steam was secured that night, and the lights burned brilliantly, while an approximate record showed a saving of one-third in the amount of fuel consumed. Did the directors take the lesson to heart and employ a competent engineer? Hardly! A good engineer would cost $600 more per year than they were paying the lad, and if the good name of the system was injured by their method of operation, surely it was nothing out of their pockets. But they will find out sooner or later that they also suffer for their own neglect and shortsightedness. It would be interesting to learn how much the expert got for his trouble.

The Duty on Copper.

WE learn from Mr. C. A. Brown that the plan of his committee, appointed by the National Electric Light Association to petition Congress to abolish the duty on copper, is, so far as it has been formulated, to circulate such a petition among all the manufacturers and users of copper, as well as among other people interested in the subject, with a view of getting as strong an indorsement as possible of the action proposed. Mr. Brown will naturally look after the West. Mr. G. M. Phelps, of the committee, gives his attention to the New England States, Pennsylvania, New York and New Jersey, while the third member, Mr. J. F. Morrison, canvasses the South. A movement of this character is one that commends itself strongly to support in electrical circles. Our electrical industries are assuming greater importance every year, and cheap copper is a necessity, especially if we are to hold the export trade now opening up so hopefully. Any upward tendency on the part of copper in this country means an immediate restriction on the construction of new electrical plants and the extension of old ones, and we have seen occasions when the check on promising enterprises has been serious. The action of the Westinghouse Company recently in interesting itself directly in copper mines is a sign of the feeling that the late advances in copper engendered, but it is not possible for every electrical manufacturfacturing concern to nullify the effect of the duty by producing for itself. We believe that cheaper copper would be a stimulus to a host of electrical inventions and enterprises, and we cannot see that the public is benefited by the repression of development in the electrical field.

The Second State Association Organized—Maryland and the District of Columbia.

A meeting of the central station companies doing business in the State of Maryland and the District of Columbia was held Dec. 5 for the purpose of organizing a State Association.

Invitations to attend this meeting were sent to every central station company in the State and District by the secretary of a preliminary meeting held Nov. 13, 1889, for the purpose of determining the advisability of organizing a State Electric Light Association.

When the meeting came to order, it was found that those present are operating apparatuses made by the following manufacturers: Brush Electric Company, Heisler Electric Light Company, Thomson-Houston Electric Company, United States Electric Company, Westinghouse Electric Company, Waterhouse Electric Company.

The aggregate capitalization now invested in electric central stations in Maryland and the District of Columbia is estimated at $3,250,000. There was represented at this meeting a capitalization of about $1,630,000, which is over one-half of the entire investment in the State and District. Telegrams and letters were read from companies not represented, expressing their approval of the movement and their intention of becoming members of the association as soon as it was organized.

The Association was organized under the title of "The Electric Light and Power Association of Maryland and the District of Columbia." By-laws were adopted, and the following officers were elected: President, J. F. Morrison; Vice-President, H. G. Fledderman; Executive Committee, J. F. Morrison, W. T. Biedler, James B. Macneal, John Mason.

One vacancy was left in the Executive Committee to be filled by a representative of one of the Washington companies.

The office of the Association is established at 15 South street, over the Franklin Bank, Baltimore, Md., which is the official address of the secretary. The preparatory work of organization is about completed in a large number of States. It is expected that the movement will develop rapidly from this time forward, until all States are organized. Mr. A. R. Foote, Chairman of the National Committee on State and Municipal Legislation of the National Electric Light Association, is busily engaged pushing the work.

Cornell University Items.

The chief topic of interest among Sibley men at the present time is the recent efficiency test of the Mackintosh & Lyman plant at Waterloo, N. Y. The plant, which furnishes the city with light and water, consists of two Edison 500 incandescent light and three 25 arc light Hochhausen dynamos. These are run by two Mackintosh & Seymour tandem compound high-speed engines. The test, under the charge of Professors Smith, Canaga and Ryan, was participated in by about twenty-five students, and was quite complete, extending from the furnaces to the dynamos. The ammeter used was of the Ryan design, and was capable of measuring to 400 amperes. Not having a voltmeter of sufficient capacity to measure the voltage, of the arc circuit, Professor Ryan devised the scheme of causing the current to first pass through a number of closed cells containing $CuSO_4$, the cells having a siphon connection, when, on account of the high resistance of these cells, the voltmeter could then be used. The test was quite successful, and complete data were obtained for efficiency calculations.

During the term a large number of incandescent lamps have been tested by the seniors. These lamps are furnished by the manufacturers, tested by the students, and the data so obtained is made use of by the manufacturers in remedying any defects that may be found to exist. In this connection it is gratifying to note that the students' work in testing is no longer questioned, but is regarded as reliable by all concerned.

The old Senior Electrical Engineers' Association, which was so successful last year, has been reorganized, and now meets once a week. Interesting and instructive lectures have already been delivered before it by Professors Moler and Smith, Instructor Snow, etc., etc.

Electric clocks have been placed in the various Sibley rooms and connections made with the regulator in the physical laboratory. The work was done by students, under the direction of Professor Ryan.

As showing how the graduates are regarded in the outside world, Prof. Thurston's statement may be quoted, that "the number of applications by employers has of late been far in excess of the number known to be at once available and fitted for the positions to fill which they are sought."

A senior seminary has been established among the upper class Sibley men, for the purpose of reading and discussing the technical papers. It is patterned after Prof. Nichols' seminary of resident-graduate students. The several technical papers are assigned one to each member, who report weekly upon any papers or items that may attract their attention in the particular journal to which they may have been assigned. Opportunity is then afforded for discussion and the expression of individual opinion upon the points that may have been brought up during the evening.

NEW BOOKS.

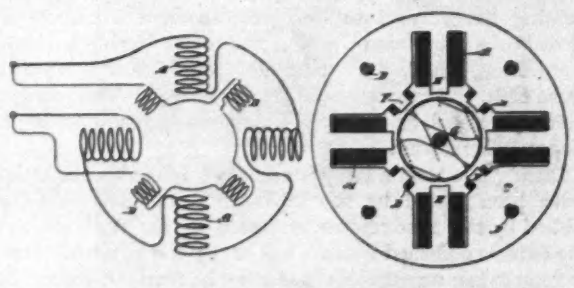
Electric Light Installations and the Management of Accumulators. By Sir David Salomons, Bart. New York. D. Van Nostrand Co. 1890. 7½ × 5¼. 99 ill. 348 pages. Price, $1.50.

This practical handbook is in reality a fifth edition, revised and enlarged, of Sir David Salomons' excellent work on handling accumulators. But its scope is far more comprehensive than that of any of the previous editions. They have dealt with the storage battery; this goes into all the various details connected with such a light and power plant as Sir David has been in the habit of operating at Broomhill, his country seat. It is possible that the subjects could receive much more expert treatment than is here given them, but we can assure our readers that they will find the book one of great interest and value. The special standpoint of the author alone is enough to give weight to his views and opinions, for it is evident that his work, undertaken simply on account of the pleasure he derives from scientific pursuits, brings out many points that other people desire to obtain information about, but have neither the time nor the facilities for satisfying themselves on. We are free to confess that we have read the book with great interest and pleasure, and noted a number of things in regard to which we are glad to have the author's opinion as based upon the observations and experiences recorded. We could wish that there were more books of this kind.

A New Type of Tesla's Alternating Current Motor.

Since Mr. Nikola Tesla's first work in alternating current motors was published by us, he has been busily engaged in working out other types, one of which we describe below. In Mr. Tesla's motors, it will be remembered, two or more energizing circuits are employed, through which alternating currents differing in phase are passed, with the result of producing a progressive shifting or rotation of the poles or points of maximum effect. Various types of alternating motors have been constructed on this principle, the present being one in which the difference of phase is artificially produced, as, for instance, in cases where the motor-circuits are of different resistance and self-induction, so that the same current divided between them will be retarded in one to a greater extent than in the other, and the requisite phase difference secured in this way.

The lag or rotation of the phases of an alternating current is directly proportional to the self-induction and inversely proportional to the resistance of the circuit through which the current flows. Hence, in order to secure the proper difference of phase between the two motor-circuits, it is desirable to make the self-induction in one much higher and the resistance much lower than the self-induction and resistance, respectively, in the other. At the same time the magnetic quantities of the two poles or sets of poles which the two circuits produce should be approximately equal. These requirements, which Mr. Tesla has found to exist in motors of this kind, have led him to the invention of a motor having the following general characteristics: The coils which are included in that energizing circuit which is to have the higher self-induction are made of coarse wire, or a conductor of relatively low resistance, and the greatest possible length or number of turns are used. In the other



Figs. 1 and 2.—New Tesla Alternating Current Motor.

set of coils a comparatively few turns of finer wire, or a wire of higher resistance, is used.

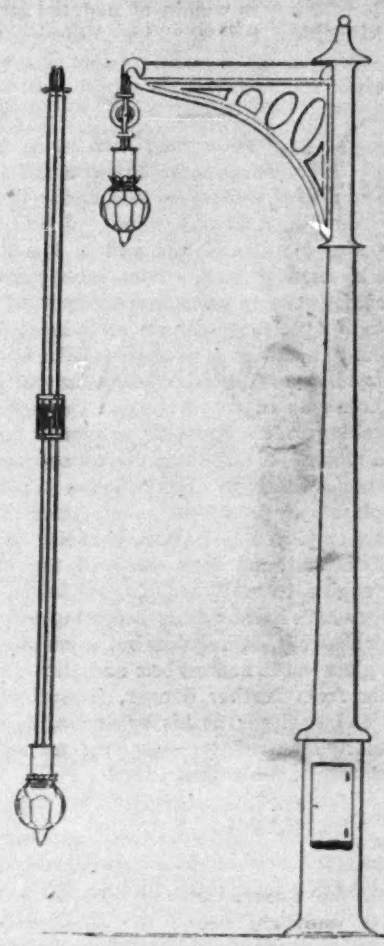
Furthermore, in order to increase the difference of phase in the two circuits, Mr. Tesla provides for the self-induction coils a considerably greater space in order to place a greater amount of copper in these coils, and in addition he envelopes these coils with iron so as to increase by these means the self-induction to the greatest possible value, and he calculates the magnetic qualities so that they are practically equal in both sets of magnets.

These features of construction are shown in the engraving Fig. 2 and the principle is illustrated by the diagram Fig. 1.

In Fig. 1, let *A* represent the coils in one motor-circuit, and *B* those in the other. The circuit *A* is to have the higher self-induction. Mr. Tesla therefore uses a long length or a large number of turns of coarse wire in forming the coils of this circuit. For the circuit *B* he employs a smaller conductor, or a conductor of a higher resistance than copper, such as German silver or iron, and winds the coils with fewer turns. In applying these coils to a motor a field-magnet is built up of plates *C*, of iron or steel. Each plate is formed with four long cores *E*, around which is a space to receive the coil and an equal number of short projections *F* to receive the coils of the resistance-circuit. The plates are generally annular in shape, having an open space in the centre for receiving the armature *G*, which is preferably wound with closed coils.

An alternating current divided between the two circuits is retarded as to its phases in the circuit *A* to a much greater extent than in the circuit *B*. By reason of the relative sizes and disposition of the cores and coils, the magnetic effect of the poles *E* and *F* upon the armature closely approximate.

An important result secured by the construction shown in the motor is, that these coils which are designed to have



Figs. 1 and 2.—Suspension for Arc Lamps.

the higher self-induction are, as above stated, almost completely surrounded by iron, by which the retardation is considerably increased.

Suspension for Arc Lamps.

We illustrate, from *Engineering*, Figs. 1 to 4, a neat contrivance for taking up the slack of the leads to arc lamps, and thus avoiding the untidy effect of loose conductors. Each conductor is wrapped around a double-grooved spring winch, which has a constant tendency to coil up the wire on both sides of it. The lamp is hung in the usual way by a steel wire strand connected at the other end to a small capstan or to a balance weight. When this strand is paid out to lower the lamp, the spring winch rotates as it descends, unwinding the coiled conductor (Fig. 1). When the lamp is again raised, the spring winch winds up the conductors, rolling them up above and below it, until it attains the position of Fig. 2. The inventors are Messrs. Sayers & Sturge, and the makers Messrs. Charles Joyner & Co., of Birmingham.

Tesla's Novel Principle of Constructing Electric Motors.

In order to obtain the maximum effective work out of a given weight of copper and iron in an alternating current motor, or any direct current motor, Mr. Nikola Tesla has applied a very important principle in their construction. Mr. Tesla reasons that in any motor the total energy supplied to do the work is equal to the sum of the energies expended in the armature and the field. The power developed, however, is proportionate to the product of these quantities. This product will be greatest when these quantities are equal; hence in constructing a motor Mr. Tesla determines the mass of the armature and field cores and the windings of both, and adapts the two so as to equalize as nearly as possible the magnetic quantities of both. In motors which have closed armature coils, this is only approximately possible, as the energy manifested in the armature is the result of inductive action from the other element; but in motors in which the coils of both armature and field are connected with the external circuit the result can be much more perfectly obtained.

In further explanation of this let it be assumed that the energy as represented in the magnetism in the field of a given motor is 90 and that of the armature 10. The sum of these quantities, which represents the total energy expended in driving the motor, is 100; but, assuming that the motor be so constructed that the energy in the field is represented by 50 and that in the armature by 50, the sum is still 100; but while in the first instance the product is 900, in the second it is 2,500, and as the energy developed is in proportion to these products it is clear that in any motor the best conditions are obtained when at normal load the magnetic quantities in field and armature are equal.

These results Mr. Tesla obtains by using the same amount of copper or ampère turns in both elements when the cores of both are equal and the same current energizes both; or in cases where the currents in one element are induced to those of the other, he uses in the induced coils a proper amount of copper.

Honors to Carl Hering.

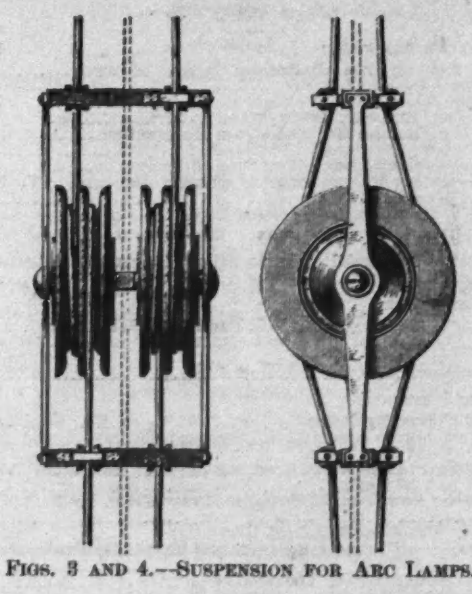
Almost immediately after the close of the Paris Exposition, Mr. Carl Hering, whose name is so intimately connected with electrical advance in the United States, received the compliment of a banquet given in his honor at the Cafe Robinet, Boulevard Montparnasse. His being invited to meet some of the leading and most potential electricians of Paris at this restaurant was most fitting and appropriate, for it is the headquarters of the little world of electrical science in Paris, as the Quartier Montparnasse is the seat of struggling and successful students in all branches of art and science. It is the headquarters of the celebrated electrical society, "de la Planche," whose monthly meetings often preceded great and new improvements or inventions in electricity, and it is no mean compliment to our fellow-countryman that he was invited to receive hospitality from his confrères in the dining hall of this most noted scientific club, composed as it is of some of the very highest men in the electrical coterie of Paris, and indeed, for the matter of that, in all France.

The menu was suited to the exigencies of the occasion and bristled with electrical allusions. This, it can be imagined, formed quite a feature, for it was composed by the worthy proprietor, himself no mean authority on electrical matters. In fact, it has often happened that the good Mons. Robinet has been called in to settle some knotty point, arising from the discussion of electrical questions by his guests.

Among the guests were such men of note as Potier, Napoli, Rechniewski, Avizard, Serpollet, Abdank-Abakanowicz, Soulages, etc., no fewer than eleven nationalities being represented as meeting to pay honor to Professor Hering. Among the Americans were Messrs. Meech, Thurnauer and Bishop, representing the greatest electrical interests of the States.

The proceedings and speeches were of a high order, and the guests separated at a late hour, proved participants of the abundant hospitality of the French savants to their professional confrère.

The recipient of these honors was doubtless impressed with the cordiality and sincerity of the demonstration, and



Figs. 3 and 4.—Suspension for Arc Lamps.

we offer him our heartiest congratulations on the happy event.

The Storage Battery Awards at Paris.

To the Editors of The Electrical World:

Having failed to observe in your valuable paper what we believe to be a correct statement regarding the awarding of medals at the Paris Exposition for accumulators, we wrote to our Mr. Camille A. Faure, now in Paris, for official particulars, and have just received his reply, which reads as follows:

"The gold medal for *invention* was awarded to Faure. (See official list of awards in *Journal Officiel de la Republique Francaise*, Sept. 30, 1889.)

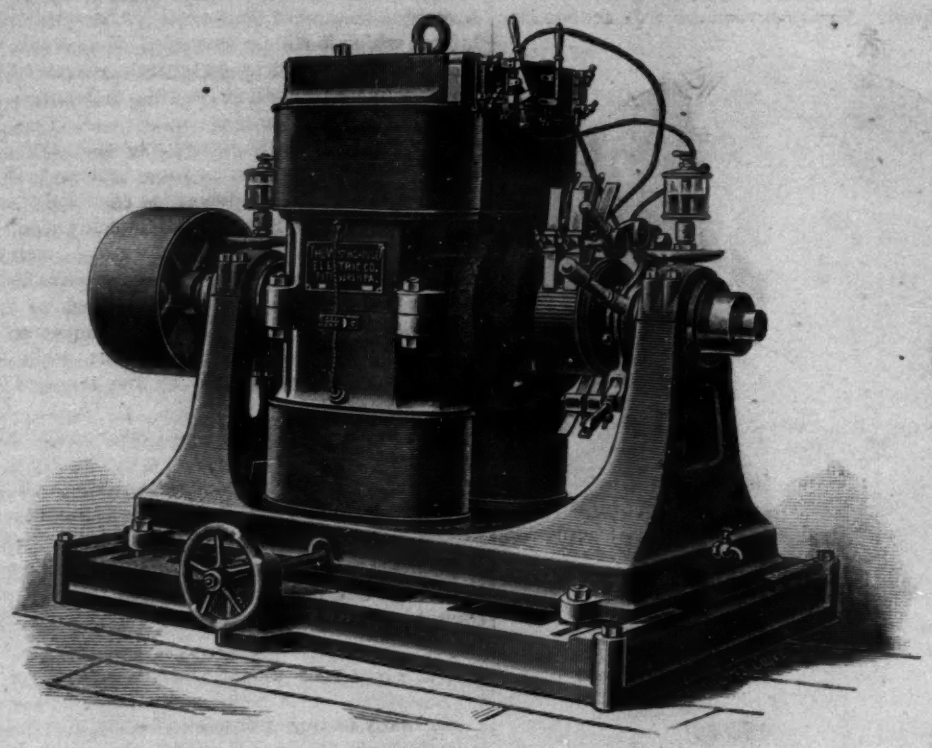
"The Société l'Electrique, of Brussels, are also awarded a gold medal for *good workmanship* and for the *general value of their exhibit*. The latter company are successors to the Société Belge et Hollandaise l'Electricité, who obtained my patents through Julien, and of which company I was for some time a director. They are still working the Faure patent in Belgium. Yours truly (signed), C. A. Faure."

D. H. Bates,
Vice-Pres't and Gen'l Manager.

P. S.—A copy of the *Journal Officiel de la Republique Française* is on my desk, if you wish to refer to it.

The New Waterhouse Arc-Light Machine.

The fact that the lighting of the streets in the cities and towns of this country by the arc light system is now recognized as the only method of supplying the proper illumination for open thoroughfares, has caused a steady improvement and a general advancement to be made in arc-light machinery. Of recent years considerable attention has been paid to the development of large machines capable of feeding a large number of lamps, and in keeping with this progress the Westinghouse Electric Company have brought out the new machine illustrated in the accompanying engraving.



IMPROVED WATERHOUSE ARC LIGHTING DYNAMO.

This machine is a development of the well-known Waterhouse machine. A peculiar distinction is its simplicity and thorough substantiality of construction. The machine is a direct-current dynamo made to run 50 lamps, but, in an emergency, it is capable of running as high as 75 lamps. Any standard lamp can be used with the machine. It is perfectly self-regulating, and will run equally well on one lamp or more, to the maximum capacity.

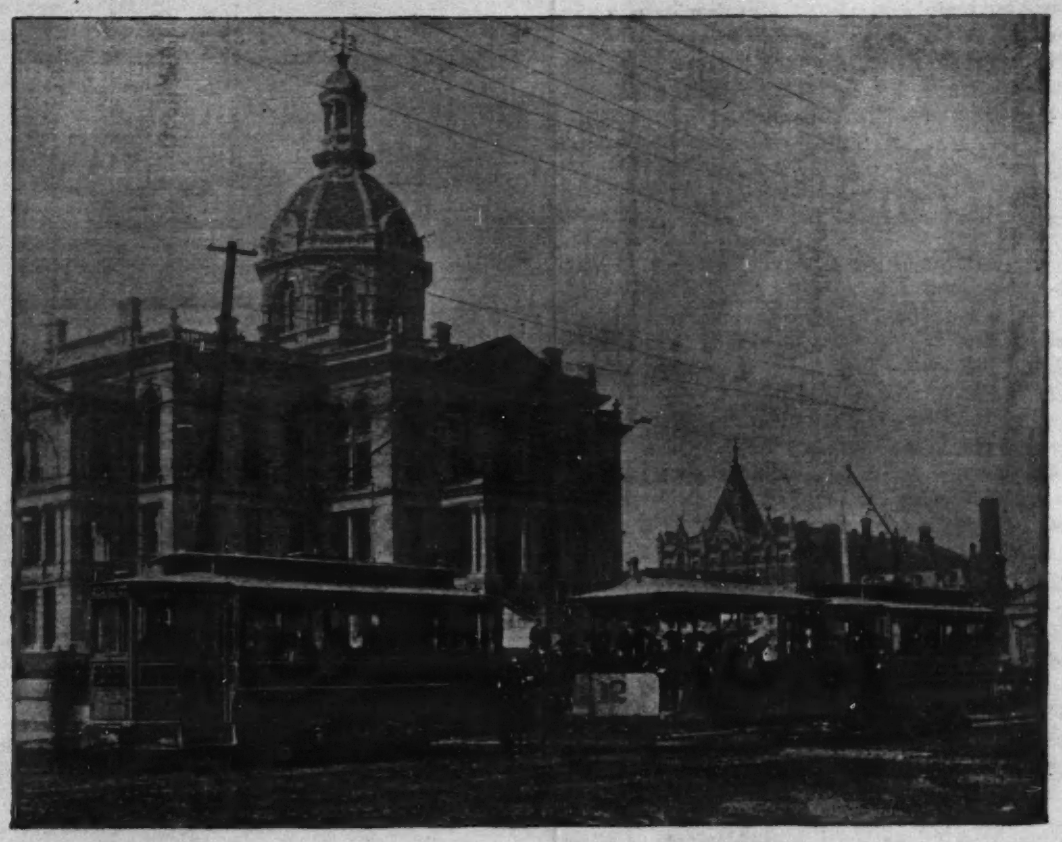
The Central Railway, Peoria, Ill.

The energy and push which characterizes our Western cities is shown in no better way than by the rapid introduction of the electric railway. Realizing the great benefits and advantages to be derived from electricity as a motive power, they have been quick to avail themselves of it. The electric railway at Peoria, which is shown in the accompanying illustration, has been in operation since Sept. 28, 1889, and, as expressed by a local paper, "without losing a single trip from any electrical trouble.

The electrical equipment was put in by the Thomson-Houston Electric Company, the overhead cross-suspension method being used throughout. The road is ten miles in length and has 15 motor cars, each equipped with two 15-h. p. Thomson-Houston motors. The steam plant consists ofthree 60″ × 18′ boilers, and one 250 h. p. Reynolds-Corliss engine, which is belted to a countershaft, to which are belted two 20 h. p. Thomson-Houston railway generators.

The cars used in Peoria are somewhat different from those ordinarily employed, as will be seen from the illustration. A closed compartment containing the controller stand and brake handle is provided at each end of the car, thus protecting the motorman in stormy weather, and separating him from the passengers and preventing interference in operating the car.

When this line was first put in operation it was compelled to take care of an unusually large traffic on account of the county fair, and this was done to the satisfaction of the public and the officers of the read.



THOMSON-HOUSTON ROAD AT PEORIA, ILL.

Test of the New Sprague Street Railway Motor.

BY DR. LOUIS BELL.

A few weeks ago I had the opportunity to make a careful test of the new type of the Sprague motor, and the results I think are of sufficient interest to publish and discuss.

In looking over the motor, the first thing that impresses one is, that it bears little or no resemblance to the well-known Sprague type of motor, but has been modified into quite a different form, resembling in outward appearance at least several other well-known motors.

In fact, most of the prominent American motors for street railway service seem to have settled down into a common and not altogether advantageous form; that is, a single magnetic circuit supported on the car axle at the yoke and furnished with a Siemens armature acting on the wheels through an intermediate gear. This form of magnet, although possessed of many advantages, gives a motor rather heavy in proportion to the power developed. A light weight motor constructed on this plan and having a relatively powerful armature is likely to have its field seriously distorted.

The added weight necessary with this type is certainly a disadvantage for most purposes. American practice in this respect seems to be quite different from English practice, where a double magnetic circuit with consequent poles and an armature relatively quite powerful seems to be the rule, and this form of motor, such as is used by Reckenzaun and Immisch, weighs, for equal power, only about half as much as the American form of motor, while its electrical efficiency is quite as great. There may be mechanical reasons for the American practice, but the increased weight so decreases the economic ratio of the system, as explained in a recent paper of mine, that efforts certainly should be made to build a lighter form of motor.

To illustrate this point, start to compute the economic ratio for a motor like the one under discussion, and then for a motor of the light weight class. In the first case we may have a 16-foot car, weighing perhaps 8,000 pounds, carrying a full load of perhaps 4,000 pounds of passengers, and motors weighing, as in the present case, 4,400 pounds. The ratio, then, between useful load and total weight is .61. Compute now the same ratio for the same car and load of passengers, having, however, motors weighing but twenty-five hundred pounds, a weight quite within the range of possibility. The ratio in this case will be .77. It is therefore clear that even if the light weight motor should have ten per cent. less electrical efficiency it still would be the more economical. It ought to be quite possible to design a motor which should not weigh more than 80 pounds per h. p. of normal out-put, and still retain a good electrical efficiency and reasonable freedom from heating. Such a motor would probably be somewhat greater in first cost, but its life should be very nearly as great as at present, and it certainly would be distinctly more economical in power than the present motors. Some of the Immisch motors for stationary service weigh less than 70 pounds per h. p, out-put and still have an electrical efficiency of 90 per cent. It should be remembered, however, that there is one case where the heavier motors are of service—when trailers are to be used extensively. In such case the increased tractional power gained by the added weight may well offset the disadvantages. Still a lighter form of motor is none the less necessary for those numerous cases where motor cars are alone employed or occasional trailers are used on light grades.

The new Sprague 15 h. p. motor has a single magnetic circuit, and the armature, instead of having a commutator at each end, has a single massive commutator containing 76 segments, with very narrow insulation between them This change in the form of a commutator is a very decided improvement, both mechanically and electrically.

One important point gained by this change is a greatly decreased induction on neighboring telephone wires. The new form of motor produces considerably less inductive effect than the old. This is due to more than one cause In the first place, the increased number of armature segments decreases the fluctuations in current, due to the fact that the brush touches two segments simultaneously. In the old form of motor this fluctuation amounts to about two per cent. of the current; in the new motor, however, it is less than half of one per cent. Besides this, the narrow insulation between the segments very much lessens a far more serious cause for fluctuation—the partial cutting off of the current by a wide insulation passing under the contact edge of the brush. The use of carbon brushes also tends to prevent this fluctuation by making it more gradual. Aside from the effect of the increased number of commutator bars noted above, this increase also lessens other minor fluctuations, so that the final effect, in spite of the increased frequency, is to lessen considerably the objectionable induction.

As a result of this the new motor as heard in a telephone gives a sound comparatively feeble and so high in pitch that it does not interfere seriously with conversation. Of course, where the interference with telephones is due to earth disturbance, as is very frequently the case, the interference is liable to be much more serious, and either form of motor might render conversation impossible.

The most marked difference between this new form of motor and the old one is, as is well known, in the winding both of armature and field, the resistance of the new motor being very much less. The connections with the switch box are the same in each, and the resistances of the coupled motors, measured cold (about 65 Fahrenheit), are as follows:

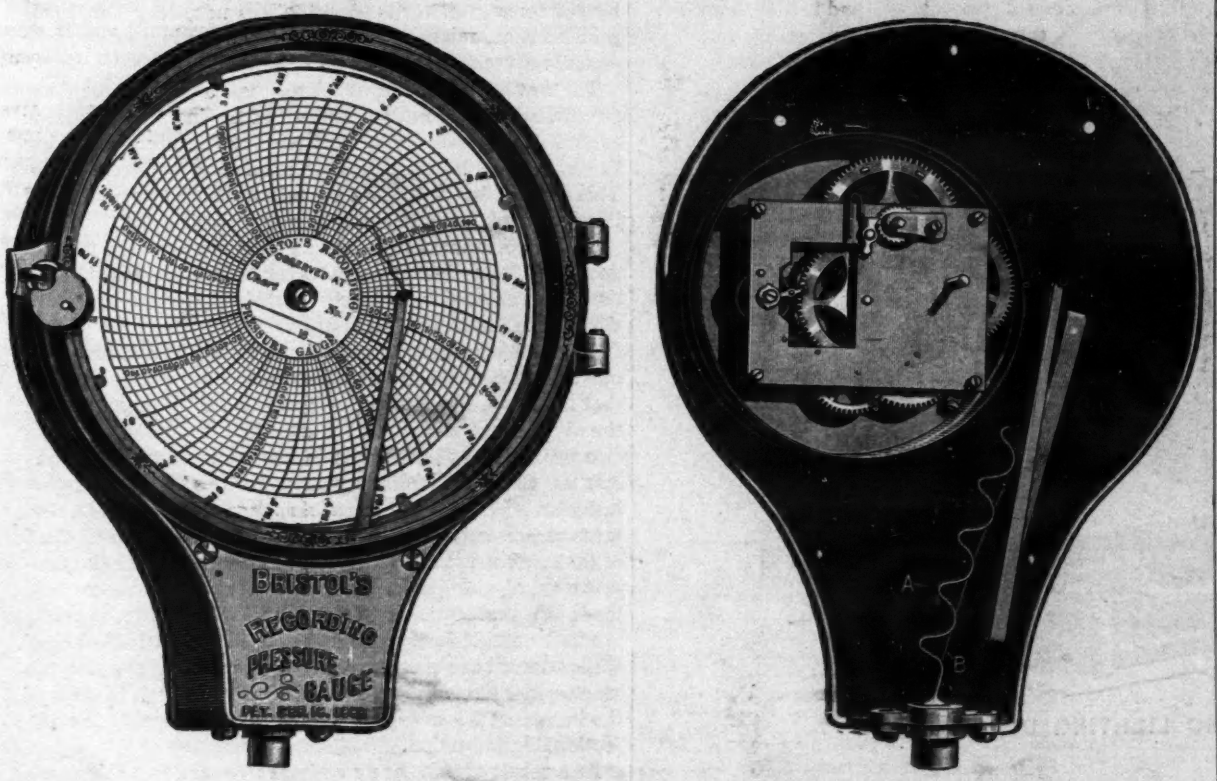
Step.	Old Motors.	New Motors.
1	10.76	4.30
2	6.98	2.95
3	6.98	2.95
4	5.44	2.10
5	2.83	1.10
6	2.83	1.10
7	2.17	0.82

The armature resistance of the old motor was about 1.2 ohms; that of the new motor is less than one-tenth of an ohm. As a result of this difference the new armature is less likely to burn out than the old one.

The gearing of the two motors, although different in detail, is about the same in effect; in the old motor the

armature makes 11.9 turns to one turn of the wheels, in the new motor 11⅛ turns to one turn of the wheels. The new motor weighs 2,200 lbs., almost exactly twice the weight of the old.

The new motor was tested by running over a measured tenth of a mile on grade, noting the speed and measuring the electrical energy on the car by means of Ayrton & Perry ammeters and voltmeters. The grade was 6.58 per cent. on the same spot at which I had previously tested the old motor some months since; the instruments used were the same in both cases, and the track, as nearly as I could judge, was in the same condition. The car, however, was but lightly loaded, and weighed about 7,800 lbs. complete.



FIGS. 1 AND 2.—BRISTOL'S NEW RECORDING PRESSURE GAUGE.

Runs were made up the hill on each step of the switch box, taking in each case a flying start, and the results were as follows:

Step.	Rate.	Arm. Speed.	Watts.	E. H. P.
1	6.00	790	11,954	16.02
2	6.00	790	12,326	16.52
4	6.30	832	12.169	16.31
5	8.00	1,053	13,124	17.59
7	7.83	1,030	12,760	17.10

Some apparent discrepancies will be noticed in the above table. These are mainly due, I think, as they were in the previous test, to variations in voltage at the station.

Computing now from these data the efficiencies of the motors we obtain far better results than with the old motor, as is shown in the following table:

			Electrical Efficiencies.	
Step.	Motor E. H. P.	Motor E. M. F.	New Motor.	Old Motor.
1	10.89	292	67.9	
2	12.92	335	78.2	39.9
4	13.83	364	84.8	59.3
5	16.03	384	91.1	76.1
7	15.92	388	93.1	78 9

In the last column is given the efficiency of the old motor for comparison. It will be seen that electrical efficiency of the new motor is very high, and that consequently the heating is much less, especially in the armature, and the life of the coil must be correspondingly greater than in the old motor.

In computing the above table 10 per cent. resistance was allowed for heating on steps two, four and five, and 15 per cent. on steps one and seven, as these were taken last, and the heating, especially on step one, was severe compared with the heating on the other steps.

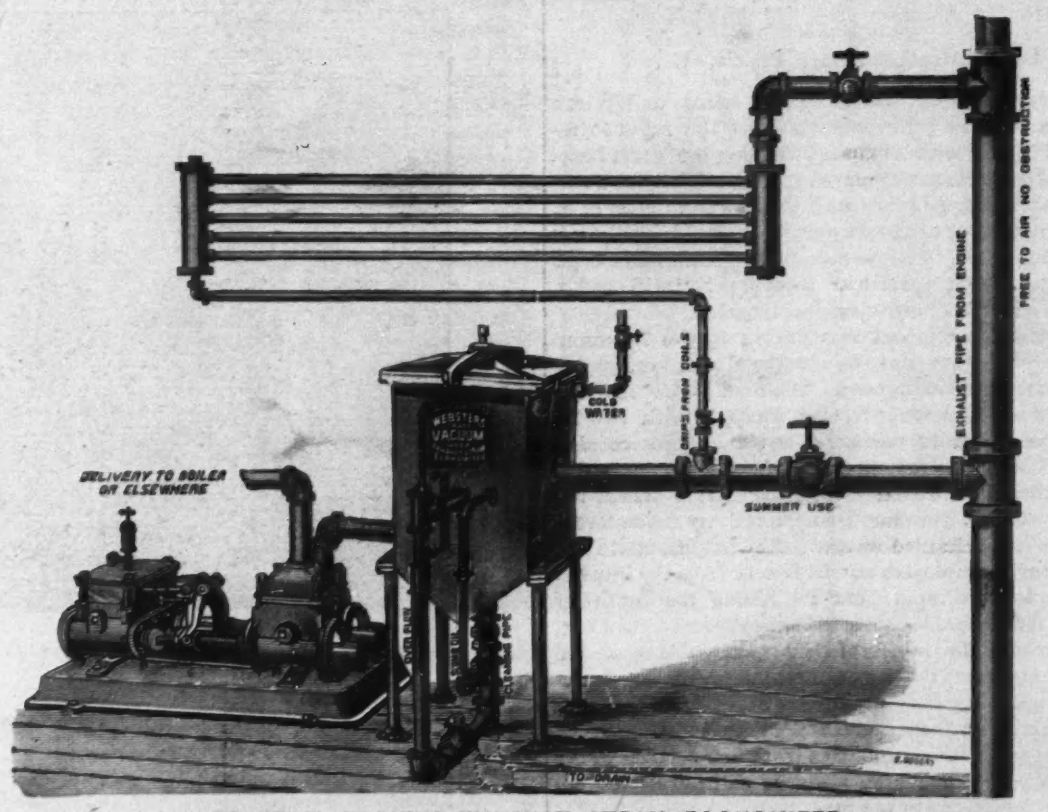
At the completion of the test, which occupied about three-quarters of an hour, at the end of a full day's run up and down the same grade, the resistance of the coupled motors was again measured at the switch box. The increased resistance gave approximately the amount of heating. The increase in resistance was nearly 16 per cent., which corresponds to a mean rise in temperature of about 72 degrees Fahrenheit.

As to the commercial efficiency of the motors I can give no exact figures. The gearing being nearly the same as in the old motors, and the hysteresis being probably nearly the same—perhaps 500 watts—it is probably safe to allow nearly the same loss from these causes as in the old motor. I think one can safely say that the average commercial efficiency is somewhere about 75 per cent., possibly as high as 80. This is a distinct gain over the efficiency of the old motors.

It would seem that it should be possible to design a motor which should give satisfactory efficiency and yet need to be geared down but once. The intermediate gear is a constant source of noise and friction, which should be avoided if possible. With respect to efficiency, this new Sprague motor leaves little to be desired, but it is much to be wished that the skill of its designer could be further exercised to make a motor about two-thirds as heavy as the present one, and which would give at least as high a commercial efficiency as the old motor with an armature speed of 500 to 600 revolutions per minute. The task is not an easy one, but I do not think it at all impossible. Light weight and little gearing are two points which should in future be aimed at. It might be desirable even to have the armature act directly on the car axle without the intervention of gearing, but whether this advantage could be secured without too great a loss of efficiency and a too great increase of bulk and weight seems at present rather doubtful.

Webster's Vacuum Exhaust Steam Economizer.

The accompanying engraving represents the vacuum exhaust steam economizer built by Warren Webster & Co., of Philadelphia. The operation of this economizer produces a partial vacuum within, thereby accelerating the inflow of steam from the source of supply, and by bringing the water and steam in direct contact in a chamber below atmospheric pressure, a greater quantity of water, it is claimed, can be heated than is the case where the water is subjected to boiler pressure. Referring to the illustration, it will be seen that the economizer can be connected with the main exhaust pipe by a branch, thereby affording convenience of application, and consuming the necessary quantity of exhaust steam to heat and purify the feed water, and relieving the engine proportionately. One of these economizers was used in connection with the steam plant of the late St. Louis Electrical Exhibition, where it gave good satisfaction.



WEBSTER'S VACUUM EXHAUST STEAM ECONOMIZER.

Bristol's New Recording Pressure Gauge.

At the meeting of the American Society of Mechanical Engineers just held in this city, Mr. W. H. Bristol, of the Stevens Institute of Technology, described an ingenious recording pressure gauge for obtaining a continuous record of the pressure carried on a steam boiler. The instrument is represented in the accompanying engravings, Fig. 1 showing it as applied ready for use, and Fig. 2 showing the mechanism.

The pressure tube A is of flattened cross section and bent into approximately a sinusoidal form. A flexible strip B, of the same metal as the tube, is secured at the ends and along the bends, as shown in Fig 2. The bent tube may be considered as a series of Bourdon springs placed end to end. Pressure applied to the tube produces a tendency to straighten each bend, or collectively to elongate the whole. This tendency to lengthen the tube is resisted by the flexible strip B and thereby converted into a multiplied lateral motion. The inking pointer is attached directly to the end of the pressure tube, as shown in Fig. 2, from which it will be seen that the usual mechanism and multiplying devices are entirely dispensed with. In the instrument illustrated the tube is designed for a range of 180 pounds per square inch.

An interesting fact in connection with the construction of the instrument is that in those first made the bent tube was obtained by electro-deposition of nickel upon a piece of solder of the proper form, the solder being afterward melted out in oil. The walls of the tube were $\frac{1}{100}$ inch thick. The printed charts for receiving the record make one revolution in twenty-four hours, and are provided with radial arcs and concentric circles, the divisions on the radial arcs corresponding to differences in pressure; while those in the concentric circles correspond to the hours of the day and night.

We may add that for the past year and a half several of these instruments have been in operation upon the boilers of the Stevens Institute of Technology, and have given perfectly satisfactory results. Besides the great delicacy of indication, with slight change of pressure, which the instrument is capable of recording, its valuable property lies in the fact that it has but a single moving part, which cannot possibly get out of order.

Johnson & Phillips' Standard Resistance.

For many testing purposes a handy form of high resistance is desirable, and to meet this want Messrs. Johnson & Phillips, of London, have recently placed one of novel form on the market. The one in use at their works has been employed for the past ten years, and calibration from time to time shows no appreciable variation in its conducting properties. An ordinary resistance coil of one meghom, made of wire, when used to take the constant of a battery and galvanometer, obviates the necessity of making allowance for the resistance of the battery itself. When the resistance is as high as the one here desccibed, very small elements, not larger than an ounce vial, answer every purpose for testing high insulation resisiances.

The material of which the resistance is made is a secret composition, and is of such a nature that it does not allow of obtaining a round number of ohms in its manufacture. But this no drawback to its usefulness. Thus, the box mentioned was found, when finished, to have a resistance of 3.89 megohms. Hence, supposing that with this box a deflection of 50 divisions is obtained, 50 divisions multiplied by 3.89 would give a constant of 194.5 divisions per megohm, as usually expressed; or, a deflection of 1 division through 9,725 megohms.

A standard coil of one megohm costs something over £20 sterling. A resistance such as described costs only about one-third as much. They are used now very extensively by the submarine cable companies throughout the world.

The E. S. Greeley Company, of New York, are the agents for this resistance in this country.

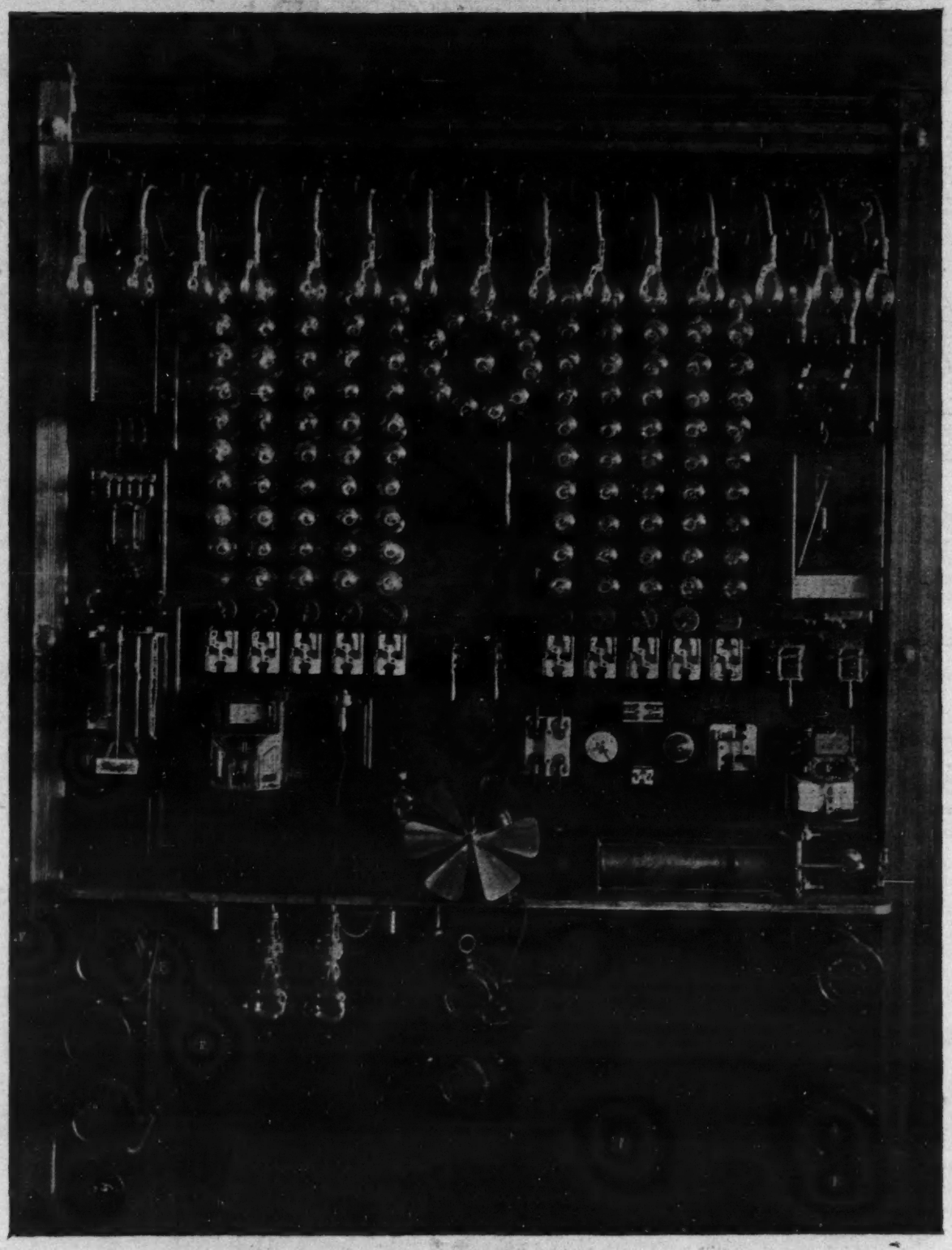
The Westinghouse Exhibition Plant in Boston.

For several weeks past the Westinghouse Company have been at work installing a complete central station outfit of their arc and incandescent systems for lighting their offices at 620 Atlantic avenue, Boston. The dynamos and station instruments are located in the basement and are driven by a Westinghouse compound engine, and, for the accommodation of persons desiring to investigate the workings of the Westinghouse systems, a neat and elaborate show-board has been erected in the main office, upon which nearly every appliance is shown in operation.

A glance at the photogravure will give an idea of the board. The top row of lamps illustrates the well known "street system" of the Westinghouse Company. In the centre of the board are two rectangular banks of fifty lamps, in addition to a circle of twelve fancy colored lamps, all of which are brought into play in showing the action of meters, regulators, etc. To the left of the lamp banks is the compensating voltmeter. On the right are the ground detector and ampère meter. Below, on one side, is a twenty-light meter in a glass case; and on the opposite side is an eighty-light meter with cover removed.

Converters of different sizes, stage regulators, a house regulator, alternating current motors, cut-outs and wiring details, a watch demagnetizer, and an automatic cigar box (which we can personally recommend) go to complete the board.

The installation, with its many unique features, was planned by the well-known district engineer of the Westinghouse Company, Mr. N. Marshall, who authorizes us to extend a cordial invitation to the electrical fraternity at large, as well as to intending purchasers, to "come in and see us" if they want any electrical apparatus, or have any watches to demagnetize or good cigars to light.



EXHIBITION BOARD IN BOSTON OF WESTINGHOUSE APPARATUS.

An Economical Process of Generating Electricity Direct from Fuel.

BY OLAF DAHL.

It is well known that the method of producing electricity by the steam engine and dynamo is very inefficient, in that only six to ten per cent. of the energy obtainable from the fuel is converted into electrical energy. Numerous other methods have been suggested. The following is a description of a new process for generating electricity direct from fuel by the aid of the gas battery.

A furnace, similar to those used in producing water gas, is charged with coke, coal or other suitable fuel. This is fired and brought to a certain temperature, more especially defined here below, by the aid of an air-blast. While the fuel is rising to the required temperature, "Siemens generator" or "producer gas" is generated and may be piped to a special holder for use as fuel gas or for other purposes. The supply of air is shut off and steam introduced to the incandescent fuel, when it has reached such a temperature that the admitted steam will be decomposed and a gaseous mixture of hydrogen and carbonic acid formed, the liberated oxygen having been combined with carbon to carbonic acid. This is attained at a temperature of about 500 degrees Centigrade with coke, and 550 degrees Centigrade with coal. To be able to guard against the temperature of the fuel becoming too high—in which case part, or all, of the carbonic acid first generated would be decomposed and carbonic oxide formed—a sample of the gas mixture from the furnace is made to pass through a solution of a chloride in muriatic acid, which absorbs the carbonic oxide, indicating its presence. Simultaneously with the admitting of the steam to the incandescent fuel, the outlet to the gasholder for the producer gas is closed, and the production in the furnace, when the steam is decomposed, is led off through condensers, wherein the steam that might have escaped undecomposed is condensed to water and the gases washed. The gas mixture next passes to the purifiers, containing chemicals, such as hydrate of lime, carbonate of sodium or potassium, or hydrate of barium, which absorbs the carbonic acid and allows the pure hydrogen to pass to a special gasholder provided for that purpose. When impurities are present in the gas mixture, they are caused to be absorbed by suitable substances before the gas mixture enters the purifier proper, thereby rendering it easier to revivify the carbonic acid absorbing chemicals. After a short time the action of the steam upon the incandescent fuel in the furnace will have so lowered the temperature that the manufacture of gas cannot be successfully continued, and it becomes necessary to discontinue the current of steam and to renew the supply of air in order to repeat the process, alternately producing producer gas and hydrogen.

The hydrogen thus produced is conducted around one electrode of a gas battery, and oxygen or an equivalent gas or mixture of gases, such as the atmospheric air, or a liquid, is employed and conducted to the other electrode of said gas battery. By this process the hydrogen is oxidized to water and an electric current set up in the circuit electrically connecting the two electrodes outside the gas battery. In order to maintain a constant current with a constant resistance outside in the battery circuit, the depth and density of the acidulated water in the battery must be kept constant. The depth is kept constant by a float in one or more of the cells, or preferably in some vessel suitably communicating with the cell or cells by opening outlets for the acidulated water at proper times. The density is kept constant in a similar manner by a hydrometer, allowing access of acid or acidulated water of higher density than that in the cells, when the density of the latter falls below a certain point. The acidulated water leaving the battery is distilled and used for that purpose.

From a ton of coke or coal are generated from 600 to 800 cubic meters of hydrogen, and as a cubic meter of hydrogen weighing 0.0896 kilogram contains energy equivalent to 4.8 h. p. hours, a ton of fuel would in this way yield electricity equivalent to from 2,880 to 3,840 electrical h. p. hours, if there were no loss in the gas battery: but with a gas battery having an efficiency of 50 per cent., as has already been made, from 1,440 to 1,920 electrical h. p. hours are generated from a ton of fuel. The gas battery will, no doubt, be improved to an efficiency of 80 to 90 per cent., when by this process there would be realized from 2,400 to 3,200 electrical h. p. hours. The same amount of fuel, when used to raise steam for running a steam engine and dynamo, will only generate from 500 to 800 electrical h. p. hours.

The gases leaving the generator at a temperature of 400 to 500 degrees Centigrade contain a large amount of heat, the largest part of which can be utilized by suitable steam generators, raising sufficient steam for running the blowers and for use in the producer, so that no fuel need be spent for that purpose.

The process will, besides furnishing electric current, give some valuable by-products, which to a large extent pay for the fuel and labor, and may even alone, under favorable conditions, pay a dividend on the capital invested.

The producer gas obtained during the period of blowing up the fuel, may be sold as fuel gas, or, enriched with naphtha or petroleum, sold as illuminating gas.

In the fuel there is always a small percentage of nitrogen present. This is converted into ammonia by the action of the steam upon the fuel and the ammonia salts are deposited in the condensers and recovered by removing the water from the condensers and distilling it with lime.

When carbonate of sodium or potassium is employed for absorbing the carbonic acid, the mono-carbonate is changed into a bi-carbonate by the absorbing of carbonic acid. If transferred to a boiler and heated in steam, the bi-carbonate may again be reduced to a mono-carbonate and be reused in the purifier. The carbonic acid driven off in the boiler is collected in a suitable receiver connected with the suction pipe of a compressing pump, and compressed into the liquid or solid state. The demand for this article for making aerated beverages is large and increasing.

It will thus be seen that by this process electricity can be generated cheaper than by any other method.

Electric Headlights for Locomotives.

Mr. G. H. Prescott, the superintendent of motive power of the Terre Haute & Indianapolis Railroad Company, writes from Terre Haute to the *Railroad Gazette* as follows:

"About two weeks ago we placed on one of our heavy passenger engines, running between Terre Haute and Indianapolis an electric headlight manufactured and sold by the National Electric Headlight Company, of Indianapolis, Ind. The apparatus consists of a combined four-cylinder engine of about three horse power, and a dynamo incased, the whole weighing about 700 pounds, and placed over the smoke arch between the headlight and smoke-stack. The light is an arc, the apparatus arranged to fit into almost any headlight case and reflector. But one carbon is used, the lower point being of copper and stationary. For any further information as to the construction, I would refer you to the manufacturers.

"As to its performance, in the two weeks it has been in service here it has given no trouble. The only attention required is to put in new carbons at the terminals. Only one observation of its value on the road has yet been made; this was on a very dark night with a misty rain falling. Under these conditions the white-washed fences leading to cattle guards could just be seen at a distance of three-fourths of a mile; a white car on the track would show up as an obstruction at nearly the same distance. a car of a

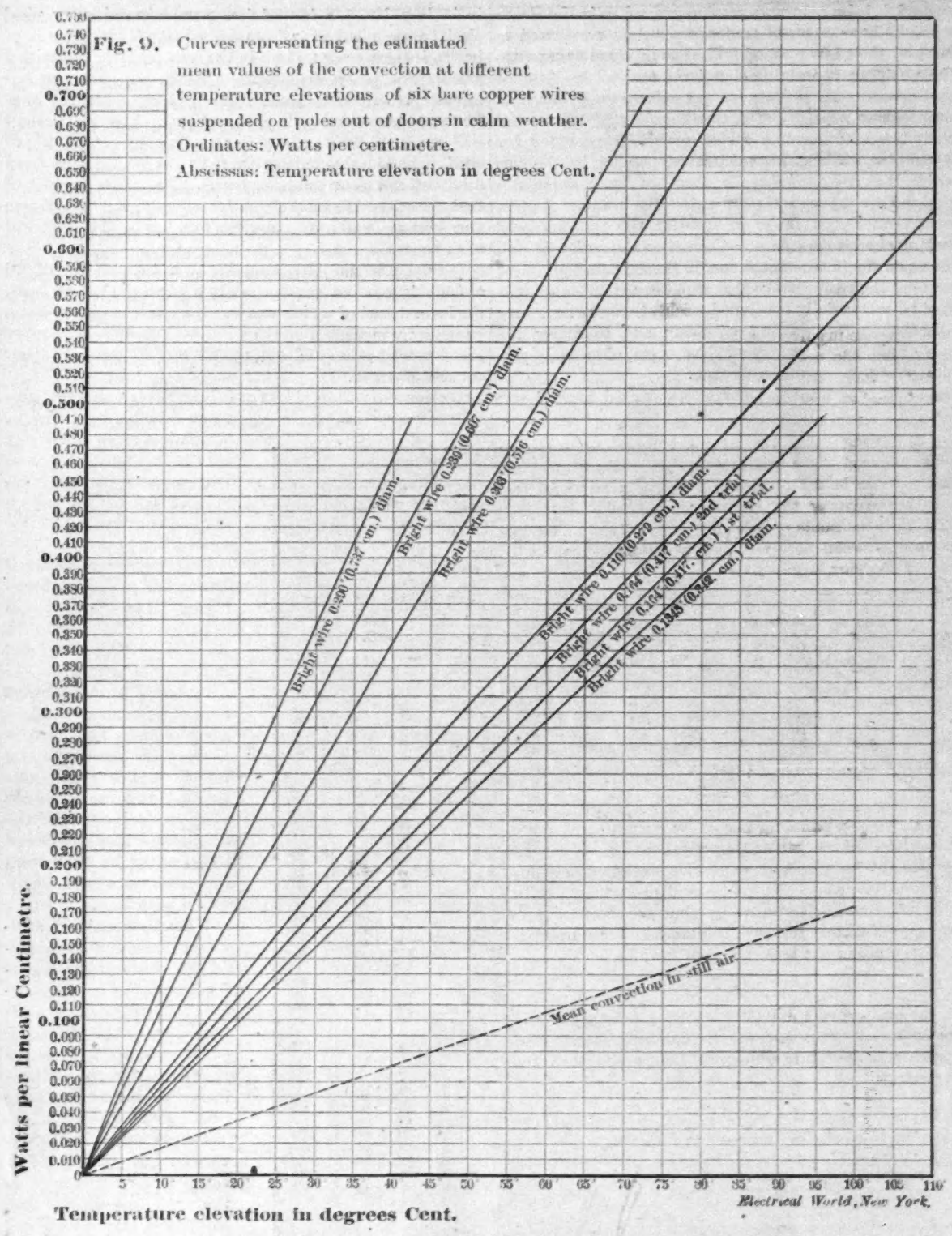

Watts per linear Centimetre.
Temperature elevation in degrees Cent.
Bright wire 0.290 (0.32 cm.) diam.
Bright wire 0.338 (0.406 cm.) diam.
Bright wire 0.368 (0.516 cm.) diam.
Bright wire 0.110 (0.279 cm.) diam.
Bright wire 0.164 (0.417 cm.) 2nd trial.
Bright wire 0.164 (0.417 cm.) 1st trial.
Bright wire 0.1355 (0.343 cm.) diam.
Mean convection in still air.
Electrical World, New York.

Fig. 9. Curves representing the estimated mean values of the convection at different temperature elevations of six bare copper wires suspended on poles out of doors in calm weather.
Ordinates: Watts per centimetre.
Abscissas: Temperature elevation in degrees Cent.

FIG. 9.—CURVES REPRESENTING VALUES OF CONVECTION.

dark color would not show plainly quite one-half of a mile; 12 telegraph poles can be plainly seen; a white mile post shows as a spot of white at a distance of half a mile; a tie at the side of track can be recognized 800 feet ahead; the white side of an ordinary switch target shows plainly a quarter of a mile ahead; colors on an old-style switch target, 12 × 26 inches, half white and half red, in vertical stripes, can be plainly seen at about the same distance; different kinds of stock can be recognized fully 1,000 feet ahead. The conclusions arrived at are that except in thick fog any serious obstruction can be seen far enough ahead to stop a train equipped with air brakes going at a speed of 45 miles per hour. The track and right of way is brightly lighted back to the pilot, where the line between dark and light is distinctively drawn; opposite the cab windows the fences and telegraph poles could not be distinguished."

On the Heating of Conductors by Electric Currents.

BY A. E. KENNELLY.

IV.

On the Heating of Conductors Suspended in the Open Air Overhead.

For these measurements nine wires were suspended about six feet (180 centimetres) from the ground parallel to each other, one foot (30 centimetres) apart and supported on glass insulators. The current was led through these wires in series, and the potential difference between points on each wire a measured distance apart observed in the usual way. The tests were made on two successive days, four wires being tried at once on the first day and six on the second, one wire having the benefit of a second trial. They were in the shade, and the temperature of the air was 28 degrees Centigrade by dry and 26 degrees centigrade by wet bulb thermometer. The weather was calm, but there were at times, particularly on the second day, slight gusts and motions of the air not amounting, however, to a steady breeze. The effect of these disturbances on the temperature of the wires was so great that the readings were all very unsteady and difficult to observe. On several occasions the effect of increasing the current in the wires was not only neutralized, but even apparently reversed by an increased motion of the air. Consequently the results obtained have been much less reliable than those deduced from similar wires indoors.

There can be little doubt that if the air out of doors were as tranquil as that in a closed room, the cooling of wires would differ in those places only in respect to radiation. This is of course seldom, if ever, the case, and the effect of the air's motion in assisting convection is very great. These results may fairly serve to indicate the maximum temperature elevation overhead wires can attain in calm weather, but to what extent the convective loss of heat can attain in windy weather is not known, and is probably many times greater than that here determined.

Fig. 8 shows the curves plotted from the observations.

Rise of temperature Degrees Cent.
Amperes.
I.
II.
No. 10 B. W. G. bare 0.1355 cm. C. M. 2,580
No. 10 B. W. G. white covered to 0.165 = 0.418 cm. C. M. 5,320
No. 10 B. W. G. bare 0.1355 = 0.343 cm. C. M. 2,580
No. 10 B. W. G. bare 0.1355 = 0.343 cm. C. M. 2,580
No. 8

Fig. 8. Curves representing the temperature elevation produced in different overhead wires out of doors, by various current strengths, in calm weather.

———·———·——— lines refer to bare bright copper wire.
- - - - - - - - - - - - - - " " to white cotton covered wires.
——————————— " " " black " " "

Wires suspended 6 feet from the ground and 1 foot apart, in shade.

Curves **I, II, III** and **IV** taken simultaneously, June 27, 1889. Temp. air 28°C., dry bulb; 26°C., wet bulb.

V, VI, VII, VIII, IX, and **X,** taken simultaneously, June 28, 1889. Temp. air 28°C., dry bulb; 24.4°C.; wet bulb.

Ordinates: Temperature elevation.
Abscissas: Ampères.

FIG. 8.—CURVES REPRESENTING TEMPERATURE ELEVATION PRODUCED IN OVERHEA

Owing to the variation in the readings, some little judgment had to be exercised in selecting the best mean values. Two of the wires were covered with white cotton, one covered with braided and blackened cotton, while the remaining six were bare, soft copper wires, such as are generally used for overhead electric light conductors. The black-covered wire is shown to have maintained about 25 per cent. less temperature elevation than the bare wire of equal diameter and conductivity. On the other hand, the white-covered wires Nos. I. and VII. in the figure were sensibly hotter than the corresponding diameters of bare wire, the elevation of No. VII. being about 10 per cent., that of No. 1 nearly 50 per cent. in excess. This large excess in the latter case is, however, perhaps attributable to the fact, discovered in working out the results, that the conductivity of this wire was low and its behavior may not have been reliable.

The fact of the cooling of a wire being assisted by an insulating covering was pointed out on theoretical grounds by Professor Forbes in his paper already alluded to. He showed that the greater radiating surface so obtained more than compensated, up to a certain thickness of coating, for the poor thermal conductivity of the insulator. It appears, however, that with these wires tested the white covering formed an exception to the rule, the surface being probably less favorable to radiation.

Curves Nos. IV. and V. represent the behavior of the same wire on the two successive days, and show the temperature elevation to have been about seven per cent. less on the second trial, owing perhaps to the greater degree of movement in the air on that occasion, as already mentioned.

Fig. 9 gives the estimated best mean values of the convection for each of the bare wires at various temperature elevations. These have been obtained by deducting from the total energy per linear centimetre the radiated loss as determined from the measurements indoors and the difference is shown as convection in watts per linear centimetre. Owing to the great variation noticed in the convection, they cannot be regarded as more than approximations, but as far as 40 degrees Centigrade of rise they appear to be nearly straight lines, with the exception of the smallest wire. The excess of convection over that found within doors is also practically proportional to the diameter of the wire. Nor is it unreasonable that while with the convection in still air where the energy of displacement is entirely supplied by the wire through conduction, the diameter of the wire may not play a prominent part; yet when the energy of the moving air is supplied from external sources and the air passing round the wire carries off its heat, the increase of convection should depend upon the extent of the hot surface exposed, and hence be closely proportional to the diameter.

The best mean values of the convection afforded by the experiments appear to be:

$0.00175 + 0.013d$ watts per linear centimetre per degree Centigrade elevation;

d being expressed in centimetres, so that the convection from an overhead wire one centimetre in diameter would be eight times as great as within doors. Modifying the previous formula to these data, it becomes:

$$c = 0.886d\sqrt{\frac{d\,(m\pi R_t + 0.013t) + 0.00175t}{r\,(1 + 0.00388T)}}.$$

Simplifying, for bright copper, $m = 1$,

$$\text{and } c = 28.9d\sqrt{\frac{570QR_t + 7.4\,d\,t + t}{1 + 0.00388T}};$$

and for blackened copper,

$$c = 28.9d\sqrt{\frac{1140QR_t + 7.4dt + t}{1 + 0.00388T}}.$$

These formulæ involve the assumption, known to be inaccurate, that the radiation has the same value out of doors as within, the error involved not being large, and they can at best only fix the maximum elevation of temperature attainable in calm weather. By their use the following table has been calculated up to 1,500 ampères, although 300 ampères was the strongest testing current. To the latter limit, however, the accuracy of the table in representing the heating as actually estimated from the measurements may be judged from the following comparison between observed and calculated currents in the case of the four largest wires.

Diameter. inches.	5 degrees Centigrade. Obs'v'd.	5 degrees Centigrade. Calcu-lat'd.	10 degrees Centigrade. Obs'v'd.	10 degrees Centigrade. Calcu-lated.	20 degrees Centigrade. Observed.	20 degrees Centigrade. Calcu-lated.	40 degrees Centigrade. Observed.	40 degrees Centigrade. Calcu-lated.
0.164.....	54	54	72	75	95	105	127	142
0.203.....	72.5	72	102.5	101	145	142	195	195
0.239.....	93	92	140	129	192	180	250	250
0.290.....	155.5	123	202	170	254.5	240	305	328

Resumé of Results.

Wires in wooden paneling heated by currents are cooled by conduction under complex numerical conditions. As the temperature of the wire and panel rise, radiation and convection come into play. No simple and precise law can be given for the limiting temperature, but the limiting safe current approximately follows the diameter in sesquiplicate ratio, or in symbols the best empirical formula is

$$c = ad^{\frac{3}{2}}$$

Also if the limiting safe diameter of an insulated paneled wire be such that twice the proposed full load upon it shall only raise its temperature 40 degrees Centigrade, then the best formula is

$$d = 0.0147\,c^{\frac{2}{3}}$$

d being in inches and c in ampères; or roughly,

$$d = \frac{c^{\frac{2}{3}}}{70}.$$

A bare wire in still air cools by radiation and convection. The radiation follows the law of Dulong and Petit. It varies with the surface nature of the wire, and also, strictly speaking, with the surface nature of surrounding bodies. For practical purposes, however, the environment may be left out of consideration and the radiation of a bright copper wire may be multiplied by a coefficient which is 1.7 for a surface of thin shellac varnish and 2.0 for a varnish of lampblack and shellac. The convection for small differences of temperature appears to be nearly proportional to the temperature elevation, and depends, among other things, upon the form of the conductor. It also seems to increase slowly with the diameter of the wire, but more than this the measurements have not thus far determined. It may be taken approximately as 0.00175 watts per linear centimetre of all wires for each degree C. of temperature elevation.

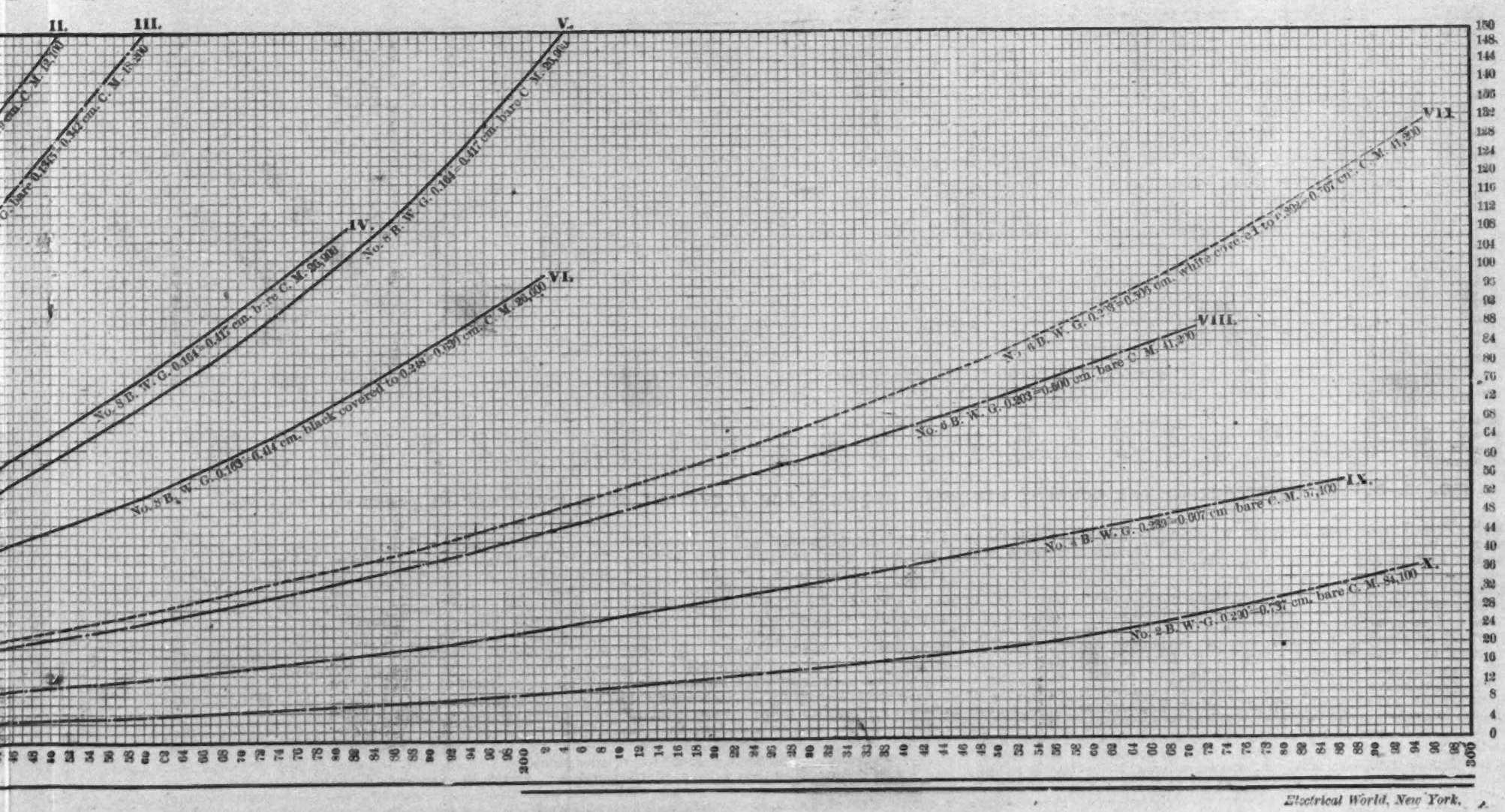
A bare wire in air out of doors is subject to a very great increase of convective cooling even in calm weather. The convection excess over that indoors may be roughly taken as $0.013 \times d$ watts per linear centimetre per degree C. elevation in calm weather, d being the diameter of the wire in centimetres.

A coating of black cotton of ordinary thickness on a suspended wire reduces the temperature elevation, but one of white cotton seems rather to increase it.

Table of current strengths (minima) which will elevate the temperature of bare overhead copper wires of 98 per cent. conductivity, 5 degrees, 10 degrees, 20 degrees and 40 degrees Centigrade in calm weather, for any given diameter up to one inch..

Diam'tr		5° C.		10° C.		20° C.		40° C.	
Inc.	Cm.	Bright.	Blackened.	Bright.	Blackened.	Bright.	Blackened.	Bright.	Blackened.
0.05	....	12	13	17	18	23	25	30	33
0.10	....	28	30	40	42	55	57	75	78
0.15	....	48	51	67	70	94	98	130	135
0.20	....	71	74	99	105	139	148	193	201
0.25	....	98	101	136	143	190	200	264	278
0.30	....	128	131	178	186	250	260	344	360
0.35	....	160	164	224	232	312	326	426	450
0.40	....	193	201	271	284	376	390	518	546
0.45	....	229	241	321	337	446	468	616	652
0.50	....	268	282	374	393	521	548	719	761
0.55	....	308	324	430	452	599	630	825	873
0.60	....	349	367	488	514	679	714	932	990
0.65	....	390	410	550	580	762	802	1,050	1,110
0.70	....	434	453	612	626	850	893	1,170	1,240
0.75	....	480	506	677	715	940	988	1,296	1,370
0.80	....	530	556	745	786	1,030	1,080	1,440	1,510
0.85	....	580	608	816	862	1,130	1,190	....	.....
0.90	....	632	662	890	934	1,230	1,300	....	.....
0.95	....	688	720	960	1,010	1,340	1,410	....	.....
1.00	....	740	780	1,030	1,080	1,440	1,520	....	.....
...	0.2	21	23	29	31	40	44	55	59
	0.4	52	54	71	75	100	105	139	145
....	0.6	90	93	125	132	175	184	244	256
....	0.8	130	141	192	200	268	280	370	388
...	1.0	190	196	264	276	367	380	506	533
...	1.2	245	257	343	360	478	501	560	600
....	1.4	310	325	432	453	602	632	816	877
....	1.6	375	393	525	553	728	765	1,000	1,060
....	1.8	443	465	625	660	870	910	1,190	1,260
....	2.0	517	544	728	765	1,010	1,060	1,400	1,470
....	2.2	586	624	839	880	1,160	1,220	....	.....
..	2.4	680	710	950	995	1,300	1,370	....	.....

This table is represented graphically by Fig. 10. (See next page).


II.
III.
V.
IV.
VI.
VII.
VIII.
IX.
X.
No. 8 B. W. G. 0.164=0.417 cm. bare C. M. 25,900
No. 8 B. W. G. 0.164=0.417 cm. black covered to 0.248=0.630 cm. C. M. 20,400
No. 6 B. W. G. 0.203=0.500 cm. white covered to 0.302=0.767 cm. C. M. 17,200
No. 6 B. W. G. 0.203=0.500 cm. bare C. M. 17,200
No. 4 B. W. G. 0.238=0.607 cm. bare C. M. 34,100
No. 2 B. W. G. 0.290=0.737 cm. bare C. M. 84,100
Electrical World, New York.

IN OVERHEAD WIRES OUT OF DOORS BY VARIOUS CURRENT STRENGTHS.

A New Form of Magneto-Testing Bell.

A new style of magneto-testing bell for electric light and other circuits has been got out and placed on the market by the Viaduct Manufacturing Company, of Baltimore, Md. A novel feature of this bell is that the ringer and gongs are *inside* the case. The handle, when not in use, is also placed inside in a receptacle made for the purpose, thus leaving no parts exposed on the outside subject to accidents. The binding-posts are made to accommodate a wire from the size of the smallest office wire up to No. 4 B. & S. gauge. The bells are wound to full standard, ringing through 10,000 ohms, and also to extra standard, ringing through 25,000 ohms. They are put up in a handsomely polished mahogany box, with a russet strap for convenience in carrying about. The size of case is 8¼ inches long, 5½ inches wide and 5 inches deep. They are offered at a very moderate price, and no doubt will have a large sale.

The Shape and Size of Incandescent Filaments.

The following interesting remarks were made on the occasion of the reading of Mr. C. J. Reed's paper on incandescent filaments before the American Institute of Electrical Engineers:

Prof. Edward L. Nichols: Every one, I think, who is interested in the study of incandescent lamps will be very glad to hear reiterated the fact, which I think none of us will desire to question, that efficiency is a function of the temperature, and not a function of the shape of the carbon and of the various other things to which it has often been ascribed. I think there can be no question on this point. It seems to me the clearest point that we have in reference to radiant energy—that the thing which we must get in order to get increased efficiency—is higher temperature, and that any method that will enable us to do this will enable us to increase the efficiency. That the temperature of the lamp cannot be measured to-day is fully, so that he has put to a very severe test the formula which he proposes, and in the article to which I referred, and which appeared in the *Repertorium der Physik*, a German paper, and which I believe has not been translated

A New Form of Magneto-Testing Bell.

into English, he claims that he has applied this formula to a variety of incandescent lamps with great success. I hope this may be true. I am sorry to say I cannot give the formula itself from memory. It is not a very simple one. It contains two or three constants which are to be determined; but, comparatively speaking, it is a simple formula. I am in hopes, therefore, that we shall, before very long, be in a position to modify Mr. Reed's statement, which at the present time is undoubtedly justified: that we do not have means of measuring the temperature of incandescent lamps. The thing, of course, which has led to much confusion in this matter is the fact that lamps behave very differently toward different observers, and at different times, and at different times toward the same observer. I think the point there is largely a matter of vacuum. The formula which we have seen developed this evening assumes either a perfect vacuum or a vacuum which is equally good in all cases, and it is a matter of fact, of course well known to all those who work with incandescent lamps, that an apparently slight difference in vacuum—really a very large difference—is the thing which changes altogether the incandescence of the filament. In other words, while conduction is an almost negligible fact in this discussion, convection, even where the amount of air remaining in the bulb is small, is by no means a negligible fact, and the failure to recognize more promptly on all sides this simple relationship is due to the fact that we have to deal with lamps which may be identical in every other respect, and yet which vary quite widely in the matter of exhaustion. I may confess that that is one of the chief difficulties which lie in the way of any one who will experiment with lamps of this kind. It can be overcome by the use of a pressure gauge measuring the vacuum in each case, but ordinarily, as we know, this is not done. I should like to call attention to a probably very well known method by means of which any one can detect slight differences in temperature in two incandescent lamps, even though he may not be able to express either one of those in degrees centigrade, and that is, by means of a very old form of photometer known as the Rumford or shadow photometer. Let any one take two lamps made with the very greatest care by our methods of to-day, and of the same type, and marked to give 16 or 20 or whatever candle power it may be, at the same voltage. Set those up so that the light from them will shine upon a sheet of white paper, and you need to interpose a block so as to get a partial shadow, there being one portion in complete shadow and two portions in partial shadow. An inspection will show that one of those shadows is always a shade bluer than the other. Now, this method, I presume, many of you have used. I have used it with very much satisfaction in attempting oftentimes to get two lamps as nearly alike as possible. This method is one which gives a very delicate means of getting relative differences of temperature, or at least of determining when two lamps are of precisely the same temperature, so that while we are not in position to express that temperature, we are in position to determine equality of temperature with a considerable degree of accuracy. It seems to me that a formula of this kind which enables one to calculate, as it does evidently with great readiness, just what the dimensions of a lamp should be, will be of great value.

The Houstholm Electric Lighthouse.

The above lighthouse, the most powerful electric lighthouse in the world, was opened a few weeks ago, and its working has given great satisfaction. Even in rainy weather its light has been distinctly visible at Blokhus, a straight distance of about 35 miles. The only undesirable incident attending the working of the new lighthouse is the immense number of birds which get killed. The light-

Fig. 10. Curves representing the current strengths required to elevate the temperatures of wires up to 1 inch in diameter 5° 10, 20 and 40° C. for bright and blackened, bare copper of 98% conductivity when suspended overhead on poles in calm weather.
Ordinates; Current strengths in amperes.
Abscissas: Diameters inches and centimetres.
Broken lines indicate bright copper.
Full Black lines indicate blackened copper.

Amperes

Diam. in Inches
Diam. in Centimetres

Electrical World, New York.

FIG. 10.—CURVES REPRESENTING THE CURRENT STRENGTH REQUIRED FOR ELEVATION OF TEMPERATURE IN WIRES (See Page 387).

probably true. I have seen, however, within a few weeks, a paper by Prof. H. F. Weber, of Zurich, which leads me to believe that the day is much nearer than we thought, when we shall be able to express the efficiency of any incandescent body in terms of its temperature directly. Professor Weber has worked out a formula which he has applied to a great variety of examples where the temperature could be measured; that is, he has gone over the literature of incandescence, and has selected all those experimental investigations which can be said to be quantitative in any fair sense of the word. Almost all the experiments deal with platinum, because platinum is a substance of which we know quite accurately the law of expansion under change of temperature and also the law of resistance with change of temperature. These various methods, however, varied among themselves apparently; but Prof. Weber seems to have been able to get out a formula which can be applied to each of them separately. They are found to fall into line beauti-

house is 209 feet high, and the light power in the beam is 2,000,000 candles. To guard against the stoppage of the light through any accident to the machinery, this is, as far as it has been possible, constructed on the twin principle. There are two engines, compound, from the Elsinore Shipbuilding and Engineering Company, three tubular boilers, one of which is a particularly quick-heating one (from the Walther establishment at Cologne, Germany) two magneto-electric machines, with a joint capacity of 45 volts, 250 ampères, from Meritens & Co., Paris, two electric lamps, with various reserve lamps, etc. In connection with the lighthouse and at a distance of respectively about 2,000 feet and 16,000 feet, are two powerful sirens, which are fed with compressed air from two air pumps in the engine-house, and which can be coupled together with the engines. At the siren stations there are reservoirs of compressed air, which are worked by means of electricity and clockwork, and great care and forethought seems to have been bestowed upon the whole installation in all its details.

The Chicago Electric Club.

President F. G. Beach called the meeting to order Monday evening, Dec. 2, with the following very sensible remarks:

"It is with no little sense of my probable unfitness for such a position, and with a full appreciation of the responsibilities entailed, that I enter upon my duties as president of this club. I feel highly honored in having been selected by you to succeed to this position, and with your kindly co-operation it shall be my aim, during the short period for which I have been chosen, to emulate so far as possible the wise and consistent policy of my predecessor in fostering the bonds of fellowship which unite us even above the diversity of business interests represented in our membership. Much remains to be done in order to provide for our members all the facilities that such a club should afford, and these matters will have my attention."

Mr. Beach will have the hearty co-operation of all the members, and especially of the officials who will join in furthering the many excellent projects for the advancement of the interests of the club that Mr. Beach has in view.

On motion of Mr. B. E. Sunny, the resolutions adopted at the last meeting of the club were dropped from the minutes. In explanation of his motion, Mr. Sunny said that while his sentiments regarding the perfect safety of high pressure currents had undergone no change, he doubted if it was in the province of the club to express such an opinion, and to prevent any future action of a similar character, he introduced the following amendment to the constitution:

While the regular meetings of the club shall be open for the free discussion of all subjects pertaining to electricity, the club shall not vote for or against any particular system or method, or express itself by vote with regard to any trade controversy unless the meeting and the subject to be considered have been duly announced to all members, and the said vote is had by the unanimous consent of the members present.

Treasurer Terry reported a balance of some $200 on hand. Mr. E. P. Meany was announced to read an interesting paper at the next meeting on the success accomplished in long distance telephony, but his enforced absence in New York will probably prevent the members from enjoying the treat. It is understood that Mr. Elmer A. Sperry will read the next paper, his subject being "Electric Motors." President Beach appointed Fred De Land, B. E. Sunny and F. S. Terry a committee to prepare and present suitable resolutions covering the death of one of the members, Mr. E. J. King, formerly of Jacksonville, Ill., and whose sad death was recorded in THE ELECTRICAL WORLD of Nov. 9.

In speaking of the good that the club will continue to accomplish, Mr. F. S. Terry believes that it will prove profitable to call upon every prominent member of the electrical fraternity to prepare a paper to be read before the club, irrespective of whether the party is a club member or not, the secretary to read the paper, if not convenient for the writer to be present. Mr. Terry firmly believes that a large number of valuable papers can thus be secured, and that men of prominence will quickly appreciate the honor of having their papers thus treated, and will carefully prepare them, with the understanding that copies shall be furnished to all the journals desiring same, as Mr. Terry believes that the club should lose none of the good that would accrue through a widespread but simultaneous report of its proceedings.

Mr. Force Bain stands ready to contribute a fine set of testing instruments and other electric apparatus as soon as the club can arrange to secure an additional room that will answer for a laboratory.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
167-177 TIMES BUILDING, NEW YORK, Dec. 9, 1889.

The Hebrew Fair Association have secured the services of the Tucker Electric Company in lighting up the American Institute Fair Building. The fair will last 14 days from December 10.

Carlisle & Hollister, 646 Fulton avenue, Brooklyn, are a firm who have started in business as contracting decorators and general electricians. The firm comprises W. G. Carlisle, F. D. Hollister, Jr., and H. G. Blackwell, Jr. They undertake electroplating and electrotyping in all its branches, and the repair of all classes of electrical apparatus.

The Niagara Steam Pump Works, of 118-122 Plymouth street, Brooklyn, under the management of Mr. Allen, are hustling and making things lively at their factory. Their "Duplex" air and steam pumps are in such demand from the large electric light, power and railway companies that it takes most of Mr. Allen's time at the factory to see that orders are promptly filled.

The River & Rail Electric Light Company is now organized as follows: George L. Wright, president and general manager; Albon Man, vice-president; Wm. Main, electrical engineer; F. F. Randolph, secretary and treasurer; E. J. Horton, assistant general manager. The factory is at 292 Graham street, Brooklyn; H. L. Fillebrown, superintendent. The company's patent attorneys are Philipp, Phelps & Hovey, and their general attorney Frederick W. Hoils.

The National Electric Protector Company, of 18 Broadway, finds a ready appreciation at this time for its protector as an adjunct to telephone and other lines. It has now been adopted by the fire alarm telegraph system in the cities of Rochester, Brooklyn, Providence, Buffalo, New Haven, Worcester, Lowell, Lynn, Woonsocket, West Newton, etc. Its efficiency has also been tested and affirmed by such men as M. D. Law, J. A. Seely, J. W. Stover and others.

The Tucker Company have just finished an installation in the Evelyn Flats on the west side, of 500 incandescent lights of the Mather system. They have also put in a Mather plant of 150 lights for the Buffalo Door and Sash Company, Harlem. They have also finished a plant for Curtis & Dean, the Thomson-Houston agents, in the Planet Mills, Brooklyn, and for the same agents they are installing 200 to 300 incandescents in a down-town restaurant. They have also contracted for 150 lights for the Mamaroneck Rubber Company, Westchester County.

Mr. W. C. Temple, of National and Metropolitan Electric Service fame, has become connected with the Babcock & Wilcox Boiler Company, 30 Cortlandt street, and will take charge of the Western half of Pennsylvania, the Eastern half of Ohio, and all the State of West Virginia. His headquarters will be in the Lewis Building, Pittsburgh. Mr. Temple has introduced about $100,000 worth of "electric service" apparatus in New York City during the current year up to Dec. 2. Mr. Temple is a professional engineer, and laid out all the steam plants for the Service Company.

J. H. Bunnell & Company, of 106 and 108 Liberty Street, are moving to 74 and 76 Cortlandt street, corner of Washington street, where they will have better facilities and light. They are constantly adding new electric light, telegraph, telephone specialties etc. The latest is Mr. Baillard's new combination adjustable lamp and socket-holder and shade-holder; and the flexible cord attachment allows the raising and lowering of the lamp to any position. They are made of hard rubber and wood, and can be made of any non-conducting substance. Their dynamos and motors are meeting with a constant demand.

P. G. Williams, 44 Flatbush avenue, Brooklyn, is doing well with his Perfection batteries, which are specially designed for family and medical use. His dial battery is a handsome set, having a large illuminated dial on the face of it that shows in degrees the exact strength of the current taken by the person using it. Mr. Williams also represents the Automatic Electric Battery Company, which is of the "nickel-in-the-slot" type, and is a fine large machine that would ornament any hall or store. It brings trade, does not get out of order, gives but a mild shock, and can be arranged to work either as a one cent or a nickel machine.

Mr. C. J. Field, late general manager of the Brooklyn Edison Company, has organized the Field Engineering Company, as consulting and constructing engineers for electric railways, electric light and power plants, and steam plants. Mr. Field has had a number of years' experience in the Edison interests, and was for two years chief engineer of the Edison United Manufacturing Company. Mr E. F. White, who is connected with Mr. Field in his new enterprise, is an able mechanical engineer, and was associated with him in the building of the Brooklyn plant. W. D. MacQuesten, who is well known in the electric field, is also connected with the new enterprise.

The Richter Electric Construction Company, 18 Cortlandt street, have a complete working model of their electric motor car and conduit system in operation at the above address, which is creating a great deal of attention. The conduit contains a double conductor, but when the car is in operation only one of the conductors, I understand, remains alive, and the circuit is completed on an outside circuit, which runs both arc and incandescent lamps at the same time the car is in operation or independent. It is a low-tension system, they tell me, of 65 volts. The motor is of Mr. Richter's special design, of horseshoe type, with gear wheel attachments to the axle of the car. The car is lighted up with incandescent lamps, and is a representative piece of skilled mechanism and beautiful car work. They have all sizes of dynamos, motors, lamps, lamp posts, etc., on exhibition.

Mr. N. W. Pratt, the treasurer and general manager of the Babcock & Wilcox Company, has, I may mention, the entire supervision of all the immense industries connected with the company, who have factories not only in the United States but in Great Britain, Germany, France and Austria. There are 10 offices, as well as two main offices and 16 foreign representatives scattered through every quarter of the globe, all reporting to Mr. Pratt. They have in use to-day in the neighborhood of 1,000,000 h. p., and the factories are now behind on orders for the next million. It is evident that Mr. Pratt must have immense executive ability. This quality he supplements by a thorough knowledge of mechanical engineering. It is an example to young men that he fills his present position, for he entered the concern as an office boy in the early seventies. The whole of this huge business owns the sway of Mr. George H. Babcock, its active president, and late the president of the American Society of Mechanical Engineers.

Lighting the Cotton Exchange.—Mr. W. A. Cromwell, Chief Engineer and Custodian of the nine-story Cotton Exchange Building on Hanover Square, is delighted with the Continental Dynamo Company's plant of 600 lights just completed there. The plant includes one of the latest type Continental machines, of 300 ampères capacity at 110 volts, and a 9 × 14 Straight Line engine from Williams & Potter. The switchboard contains switches, resistance box, and cut-outs for each of the nine floors, each floor being divided into North and South sections, controlled from the board. On each floor again are separate switches and cut-outs. Insulite lamp key sockets are used. The dynamo and engine have been beautifully decorated, under Mr. Cromwell's supervision. The bus wires were furnished by the New York Insulated Wire Company, and are of the Grimshaw type. The boilers, pumps, etc., are of the Henry Worthington make. Kielley's automatic exhaust feed water governor regulates the feed for the pumps. Locke's damper regulator is also in use. Mr. Cromwell reports that the W M. Miller lubricating compound he is using is working wonders. He has consumed less than two barrels in four years for all the pumps, etc., and three elevators carrying an average of 10,000 passengers per day. This lubricant is made by the W. M. Miller Company, of Greenpoint avenue, Greenpoint, L. I.

W. T. H.

NEWARK, N J., Dec. 7, 1889.

Mr. C. Currier, the large manufacturer of engines, etc., is making some very fine castings for dynamos, motors, etc.

Mr. J. Allen, of the Safety Alarm Company, is filling large orders for his burglar alarms at his headquarters, 61 Mulberry street.

E. O. Chase, 363 Market street, manufacturer of light and fine interchangeable machinery, has completed a large section of Smith electric conduit, and is exhibiting it and a motor-car carying six people, to all comers.

Mr. Seymour, of Seymour & Whitlock, is testing his new electric motor, which he expects to put on the market in the spring, in connection with their fans and ventilating machines.

Mr. C. H. McIntire, of the firm of C. McIntire & Co., 36 Crawford street, was married on Nov. 27 to Miss Effie Kingsland. The officiating clergyman believes that he made an excellent McIntire joint on this occasion.

The Newark Leather Belting Company, makers of patent lapped belting, has furnished all the belts for the Newark Electric Light and Power Company, and is furnishing the belt for the new dynamo now being put in.

The Watts-Campbell Company have shipped large Corliss engines all over the world during the past year, and most of them were for electric light and power stations. The pressure on their capacity is evenly maintained.

The Weiss Storage Battery Street Car lies near the Pennsylvania depot, and in the evening I noticed two men on board charging the batteries, fixing switches, etc.; they were to run the car that evening. It is the 6-wheel friction system.

Hewes & Phillips, the well-known makers of Corliss engines, tubular boilers, etc., report that they are extremely busy filling orders for lighting plants, and that one of the latest contracts is for a large engine, etc., for a power station in Pennsylvania.

Mr. J. C. Young, of 26 Mechanic street, claims that he has the best arc lamp ever devised. The feed of the carbon is under perfect control, keeping the light steady and clear. He says he has two important negotiations for the disposal of his patents to good advantage.

Mr. McDougall, of the McDougall-Martin Electric Company, *Times* Building, New York, I found at the Market Street depot of the Pennsylvania Railroad, busily engaged in connection with the delivery of an engine he is going to install in the new factory they have secured there.

Mr. S. C. Hill, 22 Mechanic street, is the inventor of the Continental motors, regulators, governors, etc. He showed me various plans of dynamos that he proposed to build, and which he believes will make most efficient machines. The Continental Motor and Electric Supply Company, in which he is interested are also bringing out a primary battery.

Hanson, Van Winkle & Co. I found as busy as ever filling orders for their Little Wonder dynamos for plating. They are now manufacturing dynamos up to 3,000 ampères capacity; also all sizes of motors and dynamos for light and power purposes. They manufacture a full line of nickel platers' supplies, lacquers, etc. Their New York address is 92 Liberty street.

The Weston Electrical Instrument Company are as busy as their capacity will allow, and it is creditable to electrical engineering in America that so large a demand has already shown itself for these fine instruments. I trust the day is not far distant when the Weston instruments will have a reputation throughout the world such as they well deserve. The company have just issued a very neat little pamphlet about their standard direct reading voltmeters and ammeters for direct currents, and the mere description shows how much care and real genius has been bestowed on these productions.

The Newark Electric Light and Power Company, 25-33 Mechanic street, furnish current for over 4,000 incandescent and 750 arc lamps, and nearly 100 h. p. for small Sprague and Mather motors. J. D. Harrison is the president of the company; P. N. Jackson, secretary and treasurer; J. J. Gaffney, superintendent, and D. E. McCarthy, chief engineer. I took a glance at the station and found in one room, size 50 × 100, sixteen arc dynamos of 10 lights each; two fine Westinghouse 750-light alternating machines; one 600-light Weston machine and seven others of 200 lights each. In another room of the same dimensions were twenty machines, both arc and incandescent, and they are just installing a third Westinghouse 750 lighter. The three engine rooms contain two Hewes & Phillips 200 h. p. Corliss engines, one Ide engine of 90 h. p., two Watts & Campbell engines of 200 and 300 h. p.; a pair of Allen engines in reserve, and ten Hewes & Phillips' boilers of 100 h. p., with a Locke damper regulator. The officers of this station control also the Schuyler station off Market and Halsey streets, containing three Ball automatic high speed engines, two of 100 h. p., and one of 150 h. p., supping 200 arcs.

Harry W. Smith, a Newark inventor, has constructed an electric railroad on one of the wharves of the city to demonstrate a new principle in electric propulsion. It not only does away with overhead wires, but with continuous currents as well. It is a conduit system, but the conduit is without a slot, and is practically water-tight and air-tight. To keep it dry a blower or exhaust fan will force air constantly through it. The conduit is placed midway between the rails, and in the full-size model it is made of wood, with a series of heavy brass plates on top. In the bottom of the conduit is an insulated copper strip. The brass strips forming the cover of the conduit are four or five feet in length, and are rubbed by copper brushes, which conduct the current to the motor in the car. There is no flow of current outside of the conduit except directly under the car. Elsewhere the current is flowing peacefully along the copper rod in the bottom of the conduit. Connection between the copper rods and brass plates is formed by permanent magnets preceding the brushes under the car. These magnets pick up successive pallets or levers in the conduit, and the pallets form contact between the rod and the plates. As soon as the car passes one of the strips, the levers drop of their own weight and break the circuit in the conduit. One of the rails is used to form the other half of the metallic circuit, as in overhead systems. Mr. Smith's model car carries six persons rapidly. A practical road is to be put down in one of the suburbs of Newark. The car and conduit were illustrated in THE ELECTRICAL WORLD Patent Record on March 16, this year.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 8, Cook Building, cor. Franklin and Congress Sts.
BOSTON, Dec. 7, 1889.

A McIntosh & Seymour Engine of 200 h. p., and of the compound condensing type, has been ordered from J. A. Grant & Co. for the increase of the Hyde Park Electric Company's plant.

Warren S. Hill has just shipped a number of his patent magazine fuse boxes to the Utica, N. Y., Electric Light Company, and is also furnishing a number to the Thomson-Houston Electric Company, of this city, for distribution to some of their plants.

The Thomson-Houston Motor Company entertained the members of the Boston Paper Trade Association at their factory in Lynn on Wednesday of this week. A special train left Boston at 9:15 A. M., and a return was made about 2 o'clock in the afternoon.

The Edison Illuminating Company, of Boston, have just started furnishing current to a 10 h. p. Eddy motor, which they recently installed in the store of Higgins & Henderson, for the purpose of pumping water for the hydraulic freight and passenger elevators.

John P. Cushing & Co. have moved into their new premises at No. 9 Knapp street, Boston, and have now got one of the best equipped factories in this city for electro-mechanical work. Any one intrusting electrical work, however delicate, to this firm will be sure to get their orders carried out in a thorough and practical manner.

Looking up Overhead Wires.—Mayor Palmer, the Lowell Board of Aldermen, representatives of the press, of the Lowell street railway and of the New England Telephone and Telegraph Company were in Boston this week, upon invitation of Mr. Whitney, of the West End Company, to inspect the electric railway system of the latter company.

Capt. Willard L. Candee, the popular treasurer of the Okonite Company, was visiting his numerous friends in this city last week. He favored the Boston Electric Club with a visit, and was also while here entertained by the officers of the U. S. Evolution Squadron, which is at present stationed in Boston Harbor preparatory to a cruise in the Mediterranean.

Frank Ridlon & Co. have just disposed of a second-hand 10-light Weston dynamo and double lamps to a St. Louis firm, and have also sold a 10-light Weston dynamo, with single lamps, to the Thomson-Baker Coal Company, South Boston. Mr. Ridlon has also installed a four h. p. Baxter motor in Parks' Hotel, this city, and a one h. p. Baxter motor for driving sewing machines in a store in Boston.

The Eastern Electric Cable Company have declared a dividend of $1.50 per share, at the rate of 6 per cent. per annum. The business of this company is steadily increasing, and they are running at the factory day and night to fill their orders. The last four months show an increase of business of over 100 per cent., and arrangements are now being made for a very substantial increase to their factory.

The Perkins Electric Lamp Company, Hartford, Conn., have received so much encouragement from the consumers of incandescent electric lamps that they have been forced again to extend their works. They are now putting in new machinery, which enables them to manufacture 2,500 lamps a day. In the last few

months their business has grown enormously, and the Perkins lamp is meeting with great success.

Paine & Francis report having sold the following Edison apparatus: Fitchburg Railroad depot, Boston, 135-light plant, and to the pumping station of the Boston Sewerage Department, at Savin Hill, 180-light plant. The New England Wiring and Construction Company are doing the wiring for the above plants, and are also at present engaged in wiring two of the Savannah boats for annunciators, their men having to sail in the boats while doing the work.

Pettingell, Andrews & Co. have added another to their number of specialties, having become sole agents for the Davis tree insulator. This is a small metal attachment which is intended for use in fastening the wire to any ordinary glass or porcelain insulator on the limb of a tree, in such a manner that the wire is free to move as the tree swings with the wind. The sale of these articles is already very large, and they bid fair to have a long and successful run.

Lieut. H. Hutchins, of the U. S. cruiser "Boston," and Mrs. Hutchins were welcome visitors to this office this week. Mr. Hutchins is well known to most electricians as having for so long been connected with the torpedo station at Newport, R. I., where he gave particular attention to the development of electricity as applicable to marine warfare. Mr. Hutchins sails on Saturday with his ship to Lisbon, en route for a protracted cruise in the Mediterranean.

Visitors to Lynn.—The Thomson-Houston Electric Company entertained the officers of the squadron at present in Boston Harbor at their factory in Lynn this week. Electricity is now a necessity on board of these cruisers, and this visit proved of the utmost interest to the officers, who are only too glad to improve their knowledge on electrical matters by any such enjoyable means as a visit to this enterprising city, which is the home of such an important institution as the Thomson-Houston Company.

E. S. Ritchie & Sons, Brookline, Mass., have just completed a new form of Wiedemann galvanometer, which they are introducing to the electrical companies as a valuable test instrument. This company make all kinds of valuable testing apparatus at prices a great deal more reasonable than those of foreign manufacture, and are yet willing and ready to guarantee that they will give the same satisfaction. A full line of instruments is always kept on hand, and any special instrument can readily be made to order.

The Westinghouse Electric Company, through their New England office, report the sales of the following apparatus: Bridgewater Electric Company, Bridgewater, Mass., 750-light alternating dynamo and 35-light arc dynamo; Greenfield Electric Light and Power Company, Greenfield, Mass., 750-light alternating dynamo; School for Feeble Minded, Waltham, Mass., 126-light plant; Nelson B. White & Son, Winchendon Springs, Mass., 240 lights; Carew Manufacturing Company, South Hadley Falls, Mass., 50-light plant and Westinghouse engine; L. B. Clark & Co., Kingman, Me., 60 light plant.

An Excellent Record.—For seven long years a pair of Diamond carbon cells have furnished the necessary current to operate an electric clock belonging to the Warner time system, wherein the circuit is opened and closed each and every minute during the 24 hours, making a total of about 370,000 consecutive breaks during the period mentioned. The only attention required has been the occasional renewal of the zinc and sal ammoniac, and a more economical or better record could scarcely be desired. These particular cells were sold by Mr. F. S. Terry, of the Electrical Supply Company, who was then stationed at their factory in Ansonia.

The Butterfield & Mitchell Electric Cooking and Heating Company has been organized in Waterville, Me., with a capital of $500,000. President, J. T. Clarkson; treasurer, William T. Haines; directors, H. R. Butterfield, Willis Mitchell, of Waterville; J. T. Clarkson, of Amesbury, Mass., and W. T. Haines, of Waterville. The purposes of the company are the manufacturing and selling of apparatus for cooking and heating by electricity, and for the purpose of buying and holding and making any patent cooking or heating device or apparatus by electricity, and for the sale of the same in any country, and to collect a royalty on any patent right or invention which it controls.

The Spencer Damper Regulator has been applied to the four Babcock & Wilcox boilers of the West End Railroad Company's temporary motor station on Albany street. Before its application steam varied 15 or 20 pounds, and the fireman could hardly find time to eat his dinner, which he brought with him. Now he has plenty of time, as the steam is held exactly at 140 pounds and he is happy. As soon as the new plant is completed the regulator will be moved to it and control one battery of 4,000 h. p., and another erected for another battery of same horse power, making 8,000 h. p. in all. It will then be run at 165 pounds pressure. It is claimed that the Spencer damper regulator as now arranged is the only regulator capable of controlling these high pressures with the sensitiveness and power so much desired.

The Standard Electric Company of Vermont have received a contract for a 300-light plant for the factory of W. F. Badger, Boston. They have also just closed a contract with Stephen E. Jenks, Central Falls, R. I., to install in one of his factories a plant consisting of 1,300 lights and three 30 h. p. motors. Mr. Jenks controls a large number of mills in Rhode Island, and this plant is for one mill only. This is one of the most important contracts given out recently in New England, and it is probable that before a great while Mr. Jenks may have use for some ten thousand lights. The Standard Company are also shipping a 600-light dynamo to Clinton, N. J., to be run by water power for a small central station. The population of Clinton is only about 1,500, but it has already decided to have a central station, and every person of importance is taking the light both for stores and residences.

Boston Electric Club.—At the regular monthly meeting of the Boston Electric Club held this week, Mr. Henry B. Cram was nominated as president in place of Mr. W. J. Denver, retiring. Mr. I. Boynton will continue to act as treasurer and Mr. R. F. Ross as secretary. The dues have been increased from five dollars to six dollars per quarter. On Tuesday evening, Mr. A. P. Wright gave a very interesting talk on "Underground Conduits," and was afterward followed by Mr. Gilley, who, having recently returned from a trip to Europe, gave some interesting information about the methods used there. A general discussion followed, Mr. Campbell, the inventor of the Campbell wire; Mr. Harrington, of the New England Telephone Company; Captain Brophy and Mr. A. C. Shaw taking part. A very enjoyable evening was spent, and it was the unanimous feeling that such evenings ought to be of more frequent occurrence.

The Boston Electric Company have recently done a large amount of electric light wiring in private residences, and are making a specialty of this work, in addition to their large electric supply business. Among the number may be noted the residences of the following: Charles Sinclair, Portsmouth, 100 lights, 50 accumulators and dynamo; Porter A. Underwood, Cambridge; Frank A. Kennedy, 80 lights; Jabez Fox, Cambridge; J. S. Blakie, Falmouth, 75 lights; Charles Legg, Chelsea; E. W. Baker, Brookline; Otis Brothers, Watertown; A. A. Sommerman, Brockton, residence and store; George E. Keith, Campello, 40 lights. This company has also just received the contract for equipping the Fall River City Hall with 500 electric gas lighting burners, 100 bells and about one mile of speaking tube. Their business continues good in all branches, and their factory is taxed to the uttermost to supply the requisite amount of goods.

An Improvement in Telegraphy.—Mr. W. S. Richards is exhibiting at 258 Washigton street, Boston, a new device which he considers a great improvement over the present method of telegraphing. Mr. Richards uses an induction coil of special construction, the secondary coil being wound with two different sizes of wire, and it is the secondary currents which go to line and operate the telegraph instruments. By this method Mr. Richards reduces the battery power necessary to a minimum, two cells being all that are required to operate a line thirty-five miles in length. As an induced current is only of momentary duration, an ordinary "buzzer" is introduced in the primary circuit, and by an ingenious arrangement the induced current, which is made by the "make" of the buzzer, is shunted, and the "break" current only goes to line, making a practically continuous current. The instruments work perfectly, and Mr. Richards is confident that there is a large field open to his invention. American and foreign patents are pending.

Boston Street Lights.—The contract made by the city of Boston Jan. 7, 1887, for lighting the streets by electricity expires Jan. 7, 1890. The city, since the former date, has been paying 65 cents per light per night, amounting in the aggregate to over $168,895 the past year. The bids for new contracts for electric lights for public street lighting, to be made on expiration of the present contract, were received at the office of the superintendent of lamps yesterday morning. They were for a period of one, three or five years, and were as follows: Boston Electric Light Company, for the city proper, East Boston, South Boston, Roxbury and Dorchester, for one year, 65 cents per lamp; for three years, 55 cents per lamp; for five years, 50 cents per lamp. Brookline Gas Light Company, for Brighton, one year, 57 cents per lamp; three years, 53 cents per lamp; five years, 50 cents per lamp. Charlestown Gas Company, for Charlestown, one year, 75 cents per lamp; three years, 55 cents per lamp; five years, 50 cents per lamp. Suburban Light and Power Company, for Roxbury, West Roxbury and Dorchester, one year, 49 cents per lamp; three years, 47 cents per lamp; five years, 45 cents per lamp. The award of the contract was taken under advisement. The Walworth Light and Power Company, who were intending to make a bid, mistook the date when proposals were to be closed. They will endeavor to put in a bid this morning for lighting the city proper at 30 cents per light, providing the city furnishes lamps and poles, or 40 cents per light and provide poles, etc., themselves.

Maritime Exhibition.—This exhibition is now fairly open to the public, and most of the exhibits are now in position. The exhibits interesting to the electric fraternity are not very numerous, but a hasty visit has enabled me to pick out the following: The most extensive electric exhibit is furnished by the Thomson-Houston Electric Company, who show their various dynamos, generators and motors, and attract a great deal of attention by their powerful search light on the roof of the building. In the basement of the building there are a 400-light incandescent dynamo, which runs the lamps in the art gallery, a 100-light incandescent dynamo, which furnishes current for the search light, situated on an elevated platform on the roof, and which flashes its piercing rays all over Boston, much to the delight of the bewidered crowds; and two 15 horse-power generators, which furnish power for the motors on the floor above. In the main hall they have a space devoted to their main exhibit, surrounded by a rail mounted with colored lights. The chief feature of the exhibit is the electric hoisting machine, the first of the kind constructed by the Thomson-Houston Company. The motor, which is of 10 h. p., is mounted on the same cast-iron frame with the hoist, and is capable of lifting 1,200 pounds at 200 feet per minute. It is intended for use on wharves for unloading coal or merchandise from ships. On the same stand is a 3 h. p. motor driving a small dynamo, which supplies current to the colored lights on the railing. Besides this exhibit a 7½ h. p. Thomson-Houston motor is used to run the press of the Boston *Daily Advertiser*, which prints a daily paper in the Exhibition, called the *Daily Kedge Anchor*. Two other Thomson-Houston motors are also used in the Exhibition, one furnishing power for a silk loom, and the other driving a Blake pump in connection with the artificial canal in the basement. The United States Signal Service have a very interesting exhibit of their various instruments by which they are able to foretell the weather. The chief instruments necessary for this purpose, and fully shown, are the anemometer, for self-registering the velocity of the wind; a tele-thermograph, a self-registering barometer, and a self-registering thermometer. A triple self-registering thermometer will be exhibited in a few days, which will show also the velocity and direction of the wind and the amount of rainfall. Lieut. Finlay's heliograph is also exhibited, an instrument for signaling either by sun flash or artificial lights. Besides these there are some very interesting aneroid barometers, mercurial barometers, spectroscopes and a very complete set of charts. Everything has been done to make the exhibit a model office, and it will be run exactly in the same routine at the regular stations, a bulletin of the observations being displayed to the gaze of the visitors. The men in charge are on duty from eight in the morning till ten at night, and take regular observations, and have telegraphic communication with the Boston office on top of the post-office building. The Holtzer-Cabot Electric Company will have an interesting exhibit, and have an Eddy motor, which is not yet set up. An Eddy motor is also used in the exhibit of the Lamson Store Service Company. The C. & C. Motor Company have got a little motor at work, which is unfortunately not visible, but which is connected with an exhibit that attracts a great deal of attention. This is a model about five feet long of the U. S. frigate "Chicago," made entirely of cigarettes and tobacco. The motor is used for turning the screw propellor, and the ship is made to rock in a very natural manner. Four tiny incandescent lights are attached, one port, one starboard, one at the stern and one at the masthead.

A. C. S.

PHILADELPHIA NOTES.

Branch office of The Electrical World,
31 City Trust Building, Philadelphia, Dec. 7, 1889.

Cyrus O. Baker, Jr., of Newark, N. J., was a visitor among the electrical interests in this city during the past week.

Electricity vs. Gas.—At the offices of the Bureau of Gas in this city Edison electric lights are now in use. Comment is unnecessary.

An Explosion of Illuminating Gas wrecked a large house and seriously injured two persons, on Wednesday evening, at 2,313 East Thompson street, Philadelphia. The reporters are hunting for the wire.

The Western Union Telegraph Company of this city has obtained permission to put its wires underground by an order passed recently by the City Council. Superintendent Gill declares that his company will make an effort to put all its wires under as soon as possible.

Married.—On Oct. 28, Mr. Albert Hopkins Chadbourne to Miss Caroline Lodge, both of this city. On Tuesday, Dec. 3, Mr. William Hazleton, junior member of the firm of Chadbourne, Hazleton & Co., of this city, to Miss Francis L. Stadelman, daughter of Mr. W. A. Stadelman.

The Sprague Company's agency in this city has just completed a noteworthy installation at the works of William Sellers & Co. (incorporated), corner Sixteenth and Hamilton streets. A 15 h. p. Sprague electric motor has been installed to operate a thirty-ton traveling crane.

The Taylor Manufacturing Company, of Chambersburg, Pa., have established a branch office in Philadelphia, in charge of Mr. Wilson, who will actively represent their well-known engines and boilers, and they will be glad to have patrons of the company call upon him.

The Cleverly Electrical Works of this city are doing a rushing business. The company's factory is being pushed to its utmost facilities to keep pace with orders. The company is having an extraordinary run on electric gas-lighting goods, particularly so from Western and Southern orders.

Electric Cars will be in practical operation on the Lehigh Avenue Street Railway, this city, by the time this notice is published. Six cars equipped with storage batteries and Sprague electric motors will be put into active service at once; and the number will be gradually increased until all the old cars are displaced.

The Electric Railway for Lancaster, Pa.—Messrs. Sumner T. Dunham and Knight Metfell, representing New York capitalists, have obtained control of the East End and Lancaster City street car lines. It is the intention to run these cars by electricity as soon as the poles are erected and other necessary appliances are ready.

The National Electric Light and Power Company has been awarded a contract for lighting with its incandescent system the new paper mill of the Segal Manufacturing Company, Camden, N. J. The former is also making an installation of incandescent lights at the extensive factory of the Mountville (Pa.) Agricultural Manufacturing Company, and which is expected to be ready to start up by the 5th of December.

The Monongahela House, at Pittsburgh, was destroyed by fire on Thursday, Dec. 5. This hotel is well known to both the telephone and electric light fraternity, including George Manson, having been the headquarters of both the national associations. Chas. Dickens, in his "American Notes," refers to the hotel as the model house of the West. It was in those days; but latterly it has not been a model hotel, and Pittsburgh is very far East.

The Edison Company of Philadelphia has a large force of men busy day and night on underground conduit work. Upward of a thousand feet of conductor has been buried during the past three weeks and as much more will have been laid in the conduits within the next fortnight. The Edison Company has at the present time upward of 40,000 incandescent (20 c. p.) lights in circuit (and in actual use) in this city, and orders are in hand for at least 10,000 additional lights.

The Novelty Electrical Works, of this city, is manifesting unusual activity. Every department is crowded with orders. Manager C. E. Trump reports: That "never before in my company's experience has the fall and winter business opened up so satisfactorily. It is with difficulty that we keep up with our orders." This company has commenced the manufacture of electric motors and small dynamo machines, which will not in the least interfere with the company's manufacturing facilities for producing its regular line of electrical supplies.

Rapid Conduit Work.—The Edison Electric Light Company, of this city, was granted a permit at 4:20 o'clock P. M., Friday, Nov. 29, to dig up the pavement on Arch street, between Fifteenth and Seventeenth streets. Before nine o'clock the following morning the ditches, for conduit purposes, were dug and at sundown the same day over 1,000 feet of main was laid. At the stroke of the midnight bells, Nov. 30, the ditches were filled in, and at noon-time on Monday, Dec. 2, no work being done between the hours of 12 P. M., Nov. 30, and 1 A. M. Dec. 2, the streets were as nicely paved as before being disturbed.

Thomson Houston Lights.—General Manager Edwin D. Mullen, of the Thomson-Houston Electric Light Company, of this city, reports the following installations of his company's arc and incandescent lights in this section for November: May's Landing Water Company, May's Landing, N. J., 400 incandescents; Hastings & Co., Philadelphia, 50 incandescents; Beaver Falls, Pa., 100 incandescents; Pottstown, Pa., Electric Light Company, 50 arc; A. Heller, Philadelphia, 70 arc; Chambersburg, Pa., 70 arc; Erie, Pa., 60 arc; Huntingdon, Pa., Electric Light Company, 650 incandescents; Geo. Thomas, 40 arc; Reading Railroad Company, 20 arc; Carnegie, Phipps & Co., Pittsburgh, 70 arc; Edison Illuminating Company, Lebanon, 50 arc; Elizabeth, N. J., Electric Light Company, 650 incandescents.

The Spellier Electric Time Company, of Philadelphia, held its annual stockholders' meeting on Monday, Dec. 2. The following officers were re-elected: William B. Bement, president; John W. Francis, secretary and treasurer; W. O. Snyder, manager; Louis H. Spellier, electrician. The following named gentlemen were elected as directors for the ensuing year, viz.: Wm. B. Bement, Louis H. Spellier, Wm. A. Redding, Horace A. Pinkham, William Bault, Frederick Schoff, Lindley Garrison, W. T. B. Roberts, David E. Nimlet. The Spellier system is meeting with success wherever it has been introduced, and it is the aim of the company to spread its system of electric time distribution to cities and towns throughout the country. The business offices and distributing station of the company are located at No. 27 South Eleventh street, Philadelphia.

The La Roche Electrical Works, of this city, have removed from 119 North Sixth street to a large building nearly opposite (No. 116), and are now nicely settled in their new quarters. The company will occupy the entire premises, which comprise the four-story and basement brick building fronting on Sixth street, and a three-story brick building midway between Sixth and Seventh streets, and a one-story extension building which connects the lower floors of the buildings first named. The building on Sixth street, with the exception of the lower floor, will be used for manufacturing purposes. The lower floor and extension will be occupied as office and show room, respectively. This company will continue on an enlarged scale the manufacture of the standard La Roche electric motors and dynamos. Manager F. A. La Roche stated to me that his company had added a cash capital of $10,000 to the business, most of which would be invested in new machinery.

Jas. W. Queen & Co., the well-known test instrument makers and importers, report the usual large sales of Ayrton & Perry and Carpentier instruments, and these favorite instruments continue to gain in popularity among the electrical fraternity. They also announce unusually large sales of Cardew voltmeters, which are being used almost exclusively in the measurement of voltage for alternating currents. These latter instruments have

had so great a demand that it has been almost impossible to keep the stock repleted rapidly enough to satisfy it. Another large invoice is expected very shortly. Their new magnetic vane instruments, which were noted and described at some length in THE ELECTRICAL WORLD some few weeks since, have proven an unqualified success, and large contracts for these instruments for station work for the well known large electrical manufacturers have either been made or are in contemplation. Queen & Co. have a lot of seventy-five of these instruments nearly completed, which will be placed upon the market in a very few weeks. They are wound to a great number of ranges of voltage and current, and show very little error, having no permanent magnets which can lose their magnetism and thus injure calibration. They also report several new sales for their large new standard resistance box, as designed by Prof. Anthony and described in your journal a few weeks since. A new megohm box is also in process of manufacture, which, when completed, will make up an entire series of resistance boxes and bridges which this enterprising firm are making in their own shop. The firm have also perfected arrangements for doing all kinds of calibration and adjustment of test instruments and standardizing of resistance boxes and accurate measurements of all kinds. They have recently been still further enlarging their facilities for electrical work, and hope during the coming year to manufacture more largely than they have ever done before, obviating, as far as possible, the necessity of going abroad for fine electrical instruments They are always glad to see electrical people at their place of business, and take pleasure in showing them around and directing their attention to new things of interest in the several branches of electrical industry.

W. I. B.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 Mallers Building, Chicago, Dec. 7, 1889.

Coffeyville, Kan., will soon have a Westinghouse alternating plant in full operation.

Shay, Stephens & Co., Chicago, are supplying a large number of firms with all the glass battery jars required.

Mr. J. T. Frank has secured a franchise and a contract for lighting the town of Alamosa, Col., with electric lights.

Mr. Harry A. Kinney, of Omaha, has secured the agency of the Brush Electric Company for the States of Nebraska and Iowa.

Matt W. Grange, night manager of the Western Union Telegraph office at Milwaukee, died of Bright's disease on the 28th inst.

The Central Electric Company, Chicago, are receiving numerous orders for their special windlass for use in raising and lowering arc lamps.

Supervisor Barry, of San Francisco, recently refused to grant a franchise to an incandescent lighting company unless the wires were to be placed underground.

Mr. D. M. Baldridge, of Wichita, is endeavoring to secure the franchise for an electric railway in Pueblo, Col. If successful, the Sprague system will be installed.

William Snowden, Treasurer of the Equitable Life Insurance Company and President of the Electric Light Company, of Waterloo, Ia., died Dec. 4, aged 56 years,

Mr. William C. Brownlee, of Detroit, was fatally injured on the 25th ult. by the falling of some cedar poles from a flat car standing in his yard, and died twelve hours later.

Poor Business.—The Kansas City Common Council, finding nothing better to do, are again agitating the question of reduced rates for telephone service, and also for street lighting.

Mr. Edward P. Meany, superintendent of the Long Distance Telephone Company, Chicago, left for New York on Thursday to attend an important meeting of the directors of the company.

The Vulcan Iron Works, Chicago, are making the handsome iron lamp posts adopted by Professor Barrett for city street lighting. This company makes a specialty of this particular line of work.

Force Bain now occupies a section of the third floor from 78 to 86 Market street, the rapid increase in his business compelling him to secure this additional room in order to care for all the work entrusted to him.

Mr. Wm. H. Bryan, secretary of the Heisler Electric Light Company, and secretary of the St. Louis Engineers Club, is in the city as a delegate to the annual convention of the managers of the engineering societies.

Mr. L. A. Ferguson, of the Chicago Edison Company, will read an interesting paper on "Applications of Electricity" before the Northwestern Association of the Massachusetts Institute of Technology this evening.

Mr. William Zimmerman, a prominent patent lawyer of Chicago, has issued a unique card having a background of dark clouds from out of which appears a flash of lightning that forms the words Electrical Patents.

Will S. Robinson, an expert operator of Grass Valley, Cal., recently secured relief for a wrecked train by cutting a telegraph wire, at the side of the roadway and sending in the message by bringing the ends of the wires together.

The Pueblo, Col., Street Railway Company is endeavoring to reorganize under the name of the Pueblo City Railway Company, with a capital stock of $500,000; and if successful proposes to introduce a system of electric propulsion.

The Johnson Steel Street Rail Company commenced suit on Dec. 2, in the San Francisco Courts against the Pacific Rolling Mills Company and the Omnibus Cable Company for infringement of patents covering their centre bearing rail.

Gen. Andrew Hickenlooper testified in the Cincinnati Court recently, that he had no connection whatever with the attempt made by H. D. Blackburn to secure information from the books of the local Brush Electric Light Company.

Prof. E. H. Mark delivered a lecture recently before the students of the Louisville High School, on the subject of electricity as a motor force. A pattern of the first dynamo made was exhibited, also models of other forms of electrical apparatus.

Capt. C. F. Dunderdale, of the Chicago office of the Westinghouse Electric Company, has secured a contract from the Illinois Steel Company for a 35-light arc plant, making the third electric plant sold to that company by Captain Dunderdale.

Judge Taft, of Cincinnati, is hearing the evidence in the suit of the City and Suburban Telegraph Association against the Inclined Plane Railway Company, to enjoin the railway company from impairing the efficiency of the telephone company system.

Dr. Louis Bell, of Chicago, has gone to Dubuque to oversee, on behalf of the railway company, the construction of the new lines of the Key City Electric Railway Company. During his stay Dr. Bell will be afforded every opportunity for thoroughly inspecting and testing the entire equipment.

A Worthy Example.—The employés of the Western Electric Company, Chicago, were the very first among the laboring classes to join in a united effort to strongly advocate the claims of Chicago for the location of the World's Fair, and have further strengthened their good work by subscribing for some $4,000 worth of stock. This amount will no doubt be still further increased, as less than 300 employés have been heard from. It is an example worthy of emulation by all large companies.

Incorporations.—The Southwestern Electrical Engineering Company, at St. Louis: capital stock $10,000—C. J. Brinaer, A. Irvine, C. R. Meston. The Electric Light and Power Company, at Petersburg, Ill., to furnish electric light and power; capital stock, $25,000; incorporators, C. D. Wright, J. G. Strodtmann and T. W. McNeeley. Storage Battery Motor Company, at Chicago; to manufacture and sell storage batteries, motors and street railway equipment; capital stock, $2,000,000; incorporators, F. E. Hinckley, F. G. Holton, and H. F. West.

Telephone Quotations.—Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes quotations on telephone stocks as follows:

Chicago	$305@$310	Cumberland	$ 69@ 70
Central Union	58@ 59	Wisconsin	114@ 115
Michigan	88@ 89	Bell of Missouri	150@ 151
Great Southern	32@ 33	Iowa Union	23@ 25
Colorado	36@ 38	Missouri and Kansas	57@ 58
Rocky Mountain Bell	40@ 41		

ELECTRIC LIGHT STOCKS.

Chicago Arc Light and Power	$73@$76	Chicago Edison Co	$100@$101

The Rice & Whitaker Manufacturing Company, Chicago, report having sold to the West Chicago Street Railway Company four Russell automatic engines to be used in driving the several electric light plants now being installed in the company's power houses. They also report that in a recent evaporation test made with a 100 h. p. Russell engine at the lighting station of the National Electric Construction Company on Washington street, Chicago, the consumption of water per indicated horse power per hour at an average load of 76 h. p., was 37 7-10 gallons. With a single valve engine, and under the existing conditions, this is considered an excellent showing.

The Western Union Telegraph Company are about to displace the thirty thousand standard gravity cells employed in their Chicago office with sixteen No. 2 Edison dynamos and four Edison special dynamos, that will be connected to three separate lines of shafting to be operated by one 10 h. p. and two 15 h. p. Sprague motors, taking current from the local lighting station; one of the two special dynamos having a potential of five volts, will be connected to the local line, and the other of twenty volts potential will be placed on the loop circuit. It is expected that the new plant will be in perfect operation on the first of January, Mr. Summers states, provided no unforseen difficulty occurs.

Mr. E. E. Keller, manager of the Keystone Construction Company, Chicago, has secured the contract for the installation of the Westinghouse system of 750 alternating incandescent lights at Dowagiac, Mich. One hundred lights of 32 candle power each will be placed on the streets, and the remainder used for inside lighting. It is worthy of note that this plant was sold under strong competition, and also that the contract was closed immediately after the visit of the committee from the City Council to the plant at Sterling, Ill., where the Westinghouse alternating system is giving such perfect satisfaction in street illumination. Mr. Keller is also installing an arc light plant of the Waterhouse system of 70 lamps at Seymour, Ind.

The Electrical Supply Company, Chicago, have lately placed an arc globe protector on the market that is meeting with ready sale. It consists of a transparent mica disc, strongly bound with copper, and absolutely non-combustible, and is intended to be placed on the inside of the globe, with the carbons passing through the aperture in the centre. Its principal advantage, however, is in the economy it effects in the saving in breakage of globes, as well as in the life of the carbons, and in this it will more than pay for itself in a very short time. This company has also issued a new circular descriptive of their excellent fuse wire, showing sizes for any strength of current from one ampère to 200 ampères, and the fusing temperature, both where inclosed within box or cut-out and where exposed to the full action of the air.

Telegraph Line Construction.—Mr. George Cutter, of Chicago, states that in building the new telegraph line from Oshkosh to Marinette an average of 10 miles of poles per day was set up, owing to the almost entire absence of surface rock, but shortly after leaving Marinette the line route led through sections of swampy ground so soft and treacherous that only slow progress could be made. Where there were no roads the poles had to be carried in on the shoulders of the men, often to the distance of one-half mile, or drawn in singly by oxen. The corduroy roads found were so narrow that the wheels of the pole truck often slipped off and would settle in the soft mud to the hubs, and in one such accident the foreman of the pole gang was pitched off the load with sufficient force to dislocate his shoulder; and on two occasions two of the pole men sank nearly to their shoulders in the soft morass while stepping on what appeared to be good ground. Notwithstanding these difficulties, excellent progress is being made, and the line will be completed to Marquette before the end of December, provided the swamps are frozen over, for between Escanaba and Marquette lie 15 miles of soft swamp through which no road runs, and in which no line can be built till the ice is sufficiently hard to permit of handling the poles on travoix. Offices have been erected or rented in the various towns, and it is hoped that messages may be sent through to Marquette on New Year's Day. Mr. Cutter also states that the authorities in each town afforded every facility for the rapid completion of the work, and all along the line the enterprise was gladly welcomed.

F. DE L.

ENGLISH NOTES.

[*From Our Own Correspondent.*]

LONDON, Nov. 20, 1889.

Meeting of the Institution of Electrical Engineers at Edinburgh.—A few days back a deputation was received by the Council of the Institution urging them to hold a meeting of the Institution at Edinburgh next year in connection with the exhibition. Once on the path of innovation nothing comes amiss, and having successfully inaugurated a system of annual dinners, the council found no difficulty in consenting to hold a meeting at Edinburgh somewhat after the fashion of the recent meeting in Paris.

The Lighting of the Houses of Parliament.—The Westminster Electric Supply Corporation, one of the numerous supply companies which have sprung into existence within the last twelve months, has just contracted to light the houses of parliament from their new central station. The job is a big one, and as our legislators will be settling the fate of some hundreds of electric light ventures during the coming session, it is to be hoped that they will be favorably disposed toward the new illuminant by the excellence of their own installation.

Electric Traction in England.—The development of electric traction in this country is still of the slowest description. The latest attack upon the tramway companies comes from the English representatives of the Thomson-Houston Company, and it will be interesting to observe what success attends Mr. Graff Baker's efforts to overcome our inertia in this direction. One thing is quite certain: no overhead system will meet with favor except in a few isolated cases. Accumulator cars or a good conduit system are alone likely to be tolerated in the streets of English towns.

Proposed Gilbert Club.—It may interest some of your readers to hear that a club to be called the "Gilbert Club" is in process of formation with the twofold object of bringing out an English edition of Dr. Gilbert's famous work "De Magnete," and to arrange for the celebration of the great man's tercentenary in the year 1890. Sir William Thomson, Lord Rayleigh, Professor Tyndall and Mr. W. H. Preece have consented to become members, and, considering his strenuous advocacy of Dr. Gilbert's claim to immortality, it is not surprising to find the name of Prof. Silvanus Thompson among the honorary secretaries.

The New Works of the Electric Construction Corporation.—This company, as your readers will perhaps recollect, is the result of the amalgamation of the E. P. S. Company, Messrs. Elwell-Parker, and one or two minor concerns. This company owns the Julien and Sprague patents for this country, and announced at its formation that it was going to make the "energetic introduction" of electric traction into this country its main feature. Its business, I am glad to say, is increasing at such a rapid rate that it has been found necessary to erect new works near Wolverhampton. The site of these works consists of about 24 acres of land, and is close to the London & Northwestern main line, and the contract for £40,000 for the erection of the necessary buildings has just been completed. The buildings will cover between four and five acres of ground.

The Institution Dinner.—Lord Salisbury's speech at the dinner of the Institution of Electrical Engineers has been the subject of much comment in the daily and weekly press. The *Spectator* distinguishes itself by a most pessimistic article thereon. The only advantage it can see in the electric telegraph is that it enables editors of daily papers to serve up every morning an unhealthy multifarious fare, the perusal of which reduces the brains of the average man to a muddled condition somewhat resembling that which would probably follow a persistent course of study of a pocket encyclopædia. As to the future, the *Spectator* dismisses Lord Salisbury's pleasant dream that the economical generation and distribution of power by electricity would tend to break up the present unhealthy aggregations of humanity with the remark that workmen much prefer the present state of affairs. It also introduces the ancient bugbear that improvements in electrical machinery would "level the half intelligent too completely with the intelligent, and lower the total average of civilization." I am glad to say that this is not the general tone of the newspaper comments.

Municipal Lighting.—Municipal authorities in this country still continue to view the introduction of electric light by a private company with suspicion, and in many cases refuse to entertain the idea in any shape or form. Others, more reasonable, give their consent after enforcing somewhat stringent conditions. Others more venturesome, and in many cases apparently in ignorance of the large measure of protection afforded them by the Electric Lighting Acts, have decided to apply themselves for powers. The number of towns which have taken this step up to date amount to over 40 and comprise some of the largest manufacturing towns in the Kingdom. The work of the Board of Trade during the past summer in connection with applications for provisional orders was heavy enough, although powers were not granted to more than about a dozen companies. At the present moment some 300 applications for provisional orders have been lodged with the Board of Trade, and there is yet time for more to be sent in. It seems, therefore, very probable that the time of the Board of Trade will be completely occupied during the coming year in settling all the details connected with the granting of electric lighting powers.

The Central London Subway Railway.—Your readers will, perhaps, recollect that last year a proposal to run an electric railway in a subway under the main streets of the city came to an untimely end in the House of Commons. The promoters of this scheme, nothing daunted, intend during the coming session to reintroduce a bill for an electric subway railway. Their plans are, however, slightly altered. The railway is to run from the district of Bayswater along Oxford street, Holborn viaduct, down Cheapside, and along King William street, at the end of which it will join the City & Southwark Subway Railway, which runs under the Thames, and will, when it is in working order afford a much needed means of rapid communication between the north and the south banks of the Thames. This latter railway is to be worked by electricity, the contract for the electrical installation being in the hands of Messrs. Mather & Platt. Following on the lines of the City & Southwark Railway, the promoters of the new scheme propose to run a couple of steel tubes through the London clay at a depth of 30 or 40 feet, hydraulic lifts at intervals affording communication with the surface. Some such railway is urgently needed to relieve the congested state of our streets, but it is already arousing the stubborn opposition of the city fathers and the city traders.

Co-Operative Telephone.—There is a movement on foot in the northern towns to take advantage of the lapsing of the telephone patents next year, to form co-operative telephone exchange systems; the present high price of the annual subscription (about £20) being one of the chief causes of the movement. It is proposed to establish in each of the towns an exchange for about two or three thousand renters, and it is estimated that such an exchange can be put up complete at a cost of about £12,000, if the radius of operation is not much more than a mile, the cost of maintenance being estimated at about £6,000. The circular which is being sent around to the leading members of the commercial community in these towns is, therefore, able to bait the proposal with the argument that the necessary capital could be raised in each case by the associates each paying about £5, and that the annual rental of their telephone would not exceed a like amount. The National Telephone Company is thus threatened with another competitor, but I very much doubt whether any form of co-operative venture would be able to compete with the existing system if the National Company choose for the purpose of competition to cut rates. Moreover, the co-operative venture would be unable to offer the advantage of inter-urban communication, and the system would probably take

some time to get into efficient working order. In fact, the Post Office seems to me to be the only formidable competitor which the National Telephone Company have to fear, when the inevitable comes and their patents lapse.

An Electrical Radiation Meter.—At a recent meeting of the Physical Society, Mr. W. G. Gregory described an ingenious method devised by him for detecting electrical oscillations. The usual method hitherto employed for this purpose has been to observe the sparks produced across a small air gap, and quantitative measurements made in this manner must, it is obvious, be extremely rough. Mr. Gregory proposes to observe the elongation of a stretched wire due to the rise in temperature produced by the currents induced in it by the rapidly varying field of force. The instrument he employs consists merely of a long glass tube joined to a piece of brass tubing, inside of which there is a stretched platinum wire fastened at one end to the glass tube and at the other to an Ayrton & Perry magnifying spring. A mirror is attached in order to register the rotation by the reflection of a beam of light on to a scale. The wire employed by Mr. Gregory was .0086 centimetres in diameter and 192 centimetres in length. The spring had a length of about 25 centimetres and gave ten complete rotations for an extension of one millimetre. With an ordinary galvanometer scale Mr. Gregory found no difficulty in reading with accuracy to a single division, which corresponded to an extension of .000005. When the oscillator was at a distance of four metres a deflection of one division was obtained. Measures were taken to make the instrument still more sensitive, and a deflection of ten divisions was then obtained with the oscillator at a distance of four metres. Whatever may be the practical value of this little instrument, it is impossible not to admire its extreme ingenuity.

Accumulator Traction in London and Birmingham.—It would seem as if accumulator cars, after many disheartening failures, were at last to come into operation in this country on a genuinely commercial scale. After several successful runs, the Central Tramway Company, of Birmingham, have ordered twelve Julien cars from the Electric Construction Corporation, which are to take their place on this company's lines as soon as ready. A small section of the North Metropolitan Tramway Company's lines is also now being entirely worked by accumulator cars. The section is worked under contract by the Electric Traction Company, the contract price being 4½d. per car mile. The Tramway Company's estimate for horse traction per car mile is 5½d. The total number of car miles which the Electric Traction Company were under contract to perform, up to Oct. 31, was 20,280, while the total actually performed was 19,877, a very satisfactory performance when want of experience is taken into account. Each car carries 96 cells arranged under the seats. By means of an ingenious switch the motor can be connected with the cells in parallel or in series required; the reversal of the motor being effected by means of a separate lever, which changes the brushes. A fully charged set of cells suffices for half a day's work, or about 30 car miles. The changing of the cells is effected with ease within the space of three minutes. I am glad to say that the running of these cars has been so satisfactory that the Tramway Company have decided to apply for powers to work the whole of their system by electricity. The perseverance of this company is certainly very creditable, and it is to be hoped that the era of failure, on this line at any rate, is a *thing of the past*. Your readers will perhaps remember that about two years ago the Elieson system was tried by the North Metropolitan Company with but indifferent success. Mr. Elieson employed a separate truck for his motor, and his accumulators were of the Planté type, the lead grid being pierced by small holes, in which were placed flat coils of thin lead and asbestos paper, no paste, paint or powder being used. More economical results would perhaps be obtained with some direct system of electric traction, but, knowing the opposition which tramway companies would encounter if they were to attempt to disfigure the streets by poles and wires, or disturb the roadway with conduits, English electrical engineers are only too glad that there seems a good chance of the adoption of any form of electric traction.

Constant Current Distribution.—Mr. Alexander Bernstein's system of distribution by means of constant current, which was described in a paper read before the Institution of Electrical Engineers, in March, 1886, and which, in spite of its ingenuity and many advantages, has not, up to the present, made any headway in this country, has since that date been improved in several minor details. The cut-out for the Bernstein series incandescent lamp, which used to be a high-resistance film of some chemical substance, which, upon the breaking of the carbon, was supposed to partly fuse and lower in resistance, is now done away with, and we have instead the following device: The carbon, which, as is well known, is in the form of a hollow rod, is attached to two nickel wires bent in such a way that they almost touch one another at a certain point. One of the wires is hammered flat, so as to form a spring which has the tendency to produce contact at this point. So long, however, as the carbon is intact this is prevented, but on the carbon becoming deteriorated it gives to the pressure of the spring, and contact ensues. For purposes of house lighting Mr. Bernstein now proposes to use 'constant current" transformers, the fields and primary armatures of which would be traversed by the main current, while the secondary armature mounted on the same spindle would move in the same magnetic field. It will be seen that a transformer of this description would have the peculiarity of running at full speed if all the lamps were in use, and of reducing its speed according to the number of lamps that were extinguished, a constant current being always maintained in the secondary armature. An ordinary tachometer, therefore, with registering dials attached to the spindle of the transformers, would form a very accurate meter. Mr. Bernstein does not regulate his E. M. F. either by shifting the brushes or shunting the field magnets, but uses a method which has been tried with considerable success at Chelsea. He merely employs a dynamo with a constant field, and takes care to maintain a constant steam pressure in the engine cylinder. As the torque of the armature varies with the current, it follows that if matters are properly proportioned a constant current of the requisite amount will be maintained in the armature so long as the steam pressure remains constant, the variable being the speed. If all the lamps are in use the dynamos will be driven at full speed. If the consumption of light or power is reduced to a minimum the machines will assume a crawling motion. As, however, the pressure in the cylinder cannot be relied upon as constant, but varies with the speed of the piston, Mr. Bernstein has found it necessary to use an ingenious electrical regulator, which is said to attain the desired result. Mr. Bernstein is of opinion that the history of alternating currents will be repeated. The Jablockkoff candle, he says, gave way to the continuous current arc lamp, and he is of opinion that the alternating current transformer will in its turn be replaced by the continuous current transformer. The advantages of the Bernstein system under many circumstances speak for themselves, and it is somewhat surprising that it has not been more employed.

THE TELEGRAPH.

The Great Northwestern Telegraph Company's system is being rapidly extended in Manitoba.

THE TELEPHONE.

Troy, N. Y.—A temporary injunction was granted to the Hudson River Telephone Company against the Watervliet Turnpike and Railway Company. The telephone company seeks to restrain the railroad company from operating its cars by the single-trolley electric system. A motion to make the injunction permanent will be argued at a special term.

Continental Telephone Company.—The last annual meeting of the stockholders of the Continental Telephone Company will be held at No. 95 Milk street, Boston, Dec. 11, at 1 o'clock p. m., for the election of officers and for the transaction of any other business that may legally come before the meeting. This will be the last meeting of this company, and it will proceed to dissolve, dividing about $10 cash per share as a final dividend. The Tropical American Telephone Company takes over its rights and business in Central and South America and West Indies. A circular of the latter company says the recent change in the Brazilian government does not effect the patents which this company controls as assignee of Profs. Bell, Blake and others.

THE ELECTRIC LIGHT.

Bath, N. Y., has decided to light its streets with forty lamps.

Griffin, Ga.—A Thomson-Houston plant will be put in by the agency at Atlanta.

Carrollton, Ky.—The Commercial Club is fostering plans for an electric light plant.

Anderson, S. C.—The Anderson Water Works Company will probably put in an electric light plant.

Fleminsburg, Ky.—The city of Fleminsburg has contracted for the erection of a Thomson-Houston plant.

Columbiana, O.—Mr. J. C. Thullen has received a contract for electric lighting for five years, at $1,250 per annum.

Tallapoosa, Ga., is to have an Edison station, in regard to which G. F. Quackinbush & Co. can give particulars.

Los Angeles, Cal.—The Los Angeles Gas Company has consolidated with the Lowe Gas and Electric Light Company.

Siam.—An electric light company has been formed at Bangkok, and nearly half the stock has been subscribed for by the king.

Tarboro, N. C.—Mr. W. E. Fountain is the Mayor of Tarboro, which has just sold bonds to erect the electric light plant proposed.

South Bethlehem, Pa.—Mr. T. Ganey, town clerk, reports that the borough proposes to put in an electric light plant of its own.

Clay City, Ky.—The Kentucky Union Land Company has contracted with the Edison Company for a plant of 1,000 incandescent lights.

Cynthiana, Ky.—The Cynthiana Electric Light and Power Company has contracted for a Thomson-Houston plant, which will be put in at once.

Gonzales, Tex.—The Gonzales Water Power Company will develop the water power of the Guadalupe River, and will furnish the facilities for an electric light plant.

The Monatiquot, Mass., Electric Light Company has been formed, with Mr. E. Avery as president, and Mr. I. Morrison as treasurer. The capital stock is $25,000.

A Heavy Stockholder.—The *Pacific Lumberman* states that Mr. Charles Pratt, of New York, has taken $160,000 worth of stock in the Willamette Falls Electric Company.

Union Hill, N. J.—The Common Council has made a contract with the Heisler Company for street lighting. A plant to cost $50,000 will be put in and completed in 60 days.

Nottingham, Ala.—The Nottingham Water and Light Company, of which C. Detrick, of 47 Broadway, is president, intends to put a plant in, connected with its water-works.

San Leandro, Cal.—The San Leandro Gas and Electric Light Company has been formed by W. J. Landers, B. C. Hawes, J. A. Goodwin, F. B. Reynolds and S. A. Brooks, with a capital stock of $100,000.

The Sperry Electric Company, Chicago, have received a diploma from the Texas State Fair and Dallas Exposition at Dallas, Tex., "for the best system of arc lighting, dynamo and regulator," exhibited.

Savannah, Ga.—The Brush Electric Light and Power Company have entered into a four-year contract with the city to furnish it with 200 lamps of 1,200 c. p. for $20,000 a year. Mr. T. P. Keck is the superintendent.

The Public Works Construction Company has been formed at Bangor, Me., with a capital stock of $250,000. Mr. F. M. Laughton is president. The company's programme includes electric light plants.

Dixon, Ill.—The Dixon Electric Light and Power Company has been formed at Dixon, Ill., to furnish light and power; capital stock, $15,000. Incorporators: F. A. Watson, I. B. Countryman, and J. F. Plummer.

The Louisiana Electric Light Company is the name of the Louisiana Electric Light & Power Company, which will increase its Fort Wayne Jenney plant in New Orleans to 4,000 arcs and 40,000 incandescents.

The Westinghouse Electric Company has received contracts for central station apparatus from Crookston, Minn., and Dowagiac, Mich., for incandescent light plants. Both plants will be of a capacity of 750 lights each.

San Francisco, Cal.—The San Francisco Electric Light and Power Company has been formed, with a capital stock of $1,000,000, and with M. Bulger, R. P. Hastings, W. McMann, J. M. Chenowith, W. C. Clark, H. G. Platt, and J. S. Humbird, as directors.

Wichita Falls, Tex.—Mr. O. P. Bacon reports to the Baltimore *Manufacturers' Gazette* that the city will grant a franchise to a good company that will put in water works and an electric light plant, and that the city will pay so much per light and per hydrant.

The Swiss Railway Union have voted that, "considering the actual position of electric lighting, it is not desirable to extend the lighting of trains by gas, but that it is preferable to continue the investigation of the electric lighting problem and to extend experiment."

The Westinghouse Machine Company is materially increasing its forces and facilities in order to keep up with the demand indicated by orders in October for 110 engines, aggregating 6,035 h. p. It is now putting a special arc and incandescent plant into their factory, so that it will be in continuous operation to the best advantage.

Municipal Plants.—The town of Wellesley, Mass, has voted to petition for the right to supply its citizens with electric lights, and in Malden, at the recent Citizens' convention to nominate a candidate for mayor, it was voted, by a large majority, to request the city council to petition for the passage of a law permitting cities and towns to supply their inhabitants with gas and electricity.

November Sales.—During the month of November the Westinghouse Electric Company sold arc light apparatus for a total capacity of 1,290 arc lamps. This is a decided increase over their arc light business of any previous month. The sales of arc light machines were made at the following places; San Francisco, Cal., 1,000 lights; Seymour, Ind., 70; South Berwick, Me., 10; Bridgewater, Mass., 35; Bloomington, Ill., 35; Du Bois, Pa., 35; Cedar Rapids, Ia., 70, and Sprague, Wash., 35.

APPLICATIONS OF POWER.

Gainesville, Ga.—Mr. H. P. Camp is in the market for electric cars.

East Portland, Ore.—The Thomson Houston Company has secured an electric railway franchise.

Macon, Ga.—Mr. G. F. Work, the president of the Macon City and Suburban Street Railroad Company, is abandoning steam dummies, and will substitute electric motors for them.

The American Electric Motor Company have removed from their old quarters to 115 Broadway, and we understand that they are turning out large quantities of their motors for general use.

Seattle, Wash.—The West Seattle and North End Electric Street Railway Company will build a road along the water front, at a cost of $400,000. The company is capitalized at $1,000,000. D. H. Gilman is interested.

Atlanta to Savannah.—E. C. Machen, of Machen, Ga., states that he will build a standard gauge electric railway from Atlanta to Savannah if the right of way is procured. The electricity will be generated by the water power of the rivers flowing in the vicinity.

Lowell, Mass.—The Sherman Electric Storage Equipment Company are putting a car on the line between Collinsville and Willow Dale. It is furnished with an Eickemeyer motor of 10 h. p. and with the Sorley storage battery made by the Anglo-American Electric Light Manufacturing Company.

Electric Railway Priority.—Ernest W. Siemens has begun suit in the United States Circuit Court against Stephen D. Field and his associates and assigns for priority in the field of electric railway invention. Mr. Field holds a fundamental patent on operating electric cars from a central generating plant, and Mr. Siemens contests his claims.

Springfield, Mass.—The directors of the Springfield Street Railway Company are to make a trial on the State street line of the trolley, or overhead electric system, provided the privilege is granted by the City Government, and it is said there is no doubt that it will be. This line will run to Forest Park. Much of it will be rebuilt, and the whole road will be placed in excellent condition. The company has asked for other important extensions on other lines, and if the electric system works well it will probably be generally adopted in that city.

PERSONALS.

Col. Gouraud, the blithe, bland and debonair, is in this country, having recently arrived from Europe.

Mr. Paul Seiler, the electrician, of San Francisco, is on a trip East, and was a caller at these offices last week.

Mr. H. W. Shurtz, Sprague agent of Portland, Ore., is on business in New York, and reports a splendid outlook for business in his territory.

Mr. Frederic Nicholls, the manager and secretary of the Toronto Incandescent Electric Light Company, has been a recent visitor to New York, and a caller at this office.

Mr. Carl Hering has been made a Chevalier of the Legion of Honor by the French Government, and in this well-deserved honor M. Abdank-Abakanowicz is associated with him.

Mr. C. A. Cooley, long connected with the Royal Electric Company, of Montreal, has retired from the position of superintendent, and has been presented with a handsome mantel-set in onyx and an address by the employés.

Prof. H. J. Ryan, of Cornell University, will read a paper before the American Institute of Electrical Engineers, at the American Society of Civil Engineers, on Dec. 17, on "Transformer Tests." It is believed that this will be one of the most interesting and valuable papers of the season.

Mr. A. Verne, chief engineer of the Paris Edison Company has been on a flying visit to this country, at the invitation of Mr. Edison, to look over Edison central stations here before laying out his new station in Paris. He has returned home, well pleased with his reception and with what he has seen.

Mr. E. C. Brown, of the *Progressive Age*, who is a member of the General Committee of the New York World's Fair, has shown much public spirit in devoting his time to a canvass for subscriptions to the guarantee fund, and has succeded in pledging already some $30,000 from the gas industry.

Mr. Nikola Tesla, whose inventions in the alternating current field have made him known throughout the world, returned from Europe last week, after a three months' trip of recreation, during which he participated in the deliberations of the Electrical Congress, and spent several days at the great Paris Exposition.

Major O. E. Michaelis, U. S. A., commandant of the United States Military Arsenal, at Augusta, and a gentleman well known among electrical and civil engineers, had a narrow escape from death on Dec. 1, while trying to rescue his little daughter from drowning. His three little children were playing on a frozen pond near the house, when the little girl and one of the boys broke through the ice. Major Michaelis rushed to the rescue of his children. Crawling out to the edge of the hole on a plank, he attempted to reach his daughter. In the act he tumbled into the pond, but he grasped her clothing and made a desperate but unsuccessful effort to reach the shore. The ice cold water chilled him, and when help arrived five minutes later he was insensible and about to sink. A private named Getchell succeeded in dragging him from the water. The little girl was drowned, but the boy was saved.

MISCELLANEOUS NOTES.

Mr. Morris Mead, Chief of the Bureau of Electricity in Pittsburgh, considers that the wires there are in excellent condition.

San Francisco, Cal.—The Singer Automatic Fire Alarm Company, of San Francisco, has been formed by E. Ransome, F. S. Chadbourne, J. N. Hastings, G. A. Knight, and M. Sheldon, with a capital stock of $200,000.

Altoona, Pa.—The Electrical Section of the Altoona Mechanics Library has appointed a committee on the subject of indiscriminate wiring. Mr. W. F. Taylor has been elected President of the Society, and Mr. W. D. Laughman, Secretary.

The New York Electrical Society.—Mr. S. Dana Greene will read a valuable paper before the Society, at Clinton Hall, Astor place, on Wednesday, Dec. 11, at 8 P. M., on "The Development of Electric Street Car Traction." The secretary also announces that Vice-President Wetzler will deliver his well-known and popular "Review of the Electrical Year" at the first meeting in January.

The Law Battery Company, of 85 John street, W. A. Childs, President, have sent THE ELECTRICAL WORLD a handsome brass circular themometer, which has been given a prominent position on the walls of this office. These thermometers have been on the market for three years, and their reputation for accuracy is fully established. Their great advantage over the ordinary forms of mercury instruments is that they can be read from a considerable distance and in a dim light.

Watchmen's Detectors for Wanamaker.—The contract recently closed by John Wanamaker for a system of watchmen's time detectors at his Philadelphia establishment, calls for one of the most extensive systems ever put in. There will be about 108 stations over the premises, all connecting with the dial at the office, where the movements of all the watchmen can be seen at a glance. It is expected to reduce the force of watchmen. The American Watchman's Time Detector Company of New York has the contract, and has commenced work upon it.

The Penn Club has been formed in Pittsburgh by a number of the employés of the Westinghouse Company. Among those who are interested in the club and are pushing its organization are Charles Paine, of the Philadelphia Company; John Caldwell, of the same company; Lemuel Bannister, of the Fuel Company; S. A. Wells, of the Construction Company; Charles S. Pease, of the Electric Company; Charles A. Terry, Esq., the solicitor of the interests; A. T. Rowand, of the Electric Company; R. D. McGunnigle, of the Allegheny County Light Company; W. D. Uptegraff, private secretary to Mr. Westinghouse; Charles Wolf, of the Philadelphia Company; S. A. Duncan, of the Light Company; W. L. McCully, of the Electric Company; J. S. Humbird, of the same concern, and many others. Mr. George Westinghouse will be the patron of the club. The club rooms will be opened about Feb. 1.

BUSINESS NOTICES.

The Continental Dynamo Company have removed to 63 Broadway, where they will be pleased to see their friends and customers.

Battery Cut-Out.—Attention is called to a simple device for disconnecting gas-lighting batteries if accidentally grounded. It is cheap, sensitive, never needs watching, and has no clockwork to be kept wound. Terms furnished by the Electric Supply Company, of Syracuse, N. Y.. No. 105 South Warren street.

Okonite Wire.—The New York *World* devoted three columns and a half in a recent Sunday issue to a description of Okonite wire, and presented testimony showing that its use will make safe electric lighting under such circumstances a certainty. The article in question created a great deal of comment in electrical circles. It contained a long description of the Okonite Company and their new factory just completed at Dundee, N. J.

Houston's Electrical Dictionary.—To the favorable press opinions already cited may be added the following: *Milwaukee Sentinel.* "The appearance of this handsome and handy volume is timely. Electrical science is growing with great rapidity, and there has been a constant accumulation of words, terms and phrases, while the lexicons have not kept pace with the increase." *Brooklyn Eagle.* "It is an ample volume of 650 pages, with about 400 illustrations to assist in defining its 2,500 terms and phrases, which are also referred, in general statement, to the principles of electrical science under which they belong. Cross references make it easy to find definitions as well as words. The book is handsomely printed."

The Pumpelly Storage Battery and Motor Company, Chicago, have had on the market for some time a small, compact, portable physician's battery, consisting of two Pumpelly cells, and having a rheostat connected in circuit. Physicians and surgeons in that vicinity speak in terms of praise of the value of this battery for supplying the necessary current required in the application of the actual cautery in treating special forms of disease. This same battery should also prove of great utility in testing circuits, etc., and wherever a heavy current of four volts potential can be employed on temporary work.

A New Declaration of Independence for all engaged in the "pursuit of happiness" in the Northwest was proclaimed by the completion of the Minneapolis, St. Paul & Sault Ste. Marie Railway, which brought substantial benefits to the residents of the North and West, and the influence of which is felt throughout the world. The road is pregnant with greater possibilities than any of equal mileage constructed since the question of inland transportation was brought to the notice of men of sagacity and courage in 1825 by the completion of the Erie canal, directing their attention to the great West. It is a potent agent for the stability of commerce, manufactures and agriculture in the Northwest. Scarcely a week has passed since the road was finished without some positive improvements being made, and it is the fixed policy of the management to continue in that direction. The new equipment is unexcelled on any American railroad; new first-class trains will shortly run from St. Paul & Minneapolis through to Montreal, Boston and New England points without change, and in shorter time than by the older roads. This is an achievement that deserves the heartiest recognition of travelers to and from the Northwest.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS ISSUED NOV. 26, 1889.

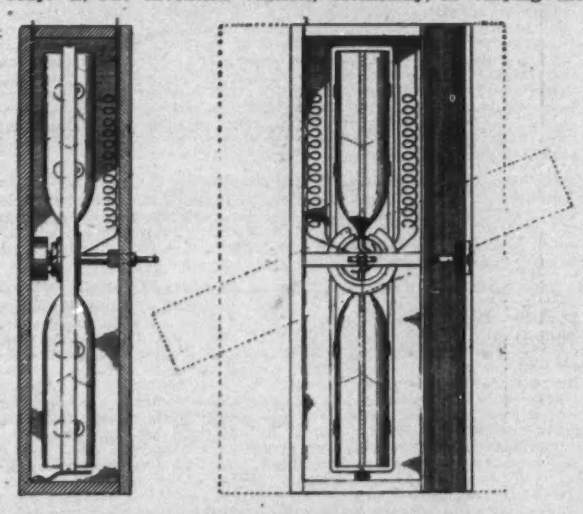
415,695. Armature Plate; Warren S. Belding, of Englewood, Assignor to the Belding Motor and Manufacturing Company, of Chicago, Ill. Application filed July 7, 1888. A sheet-metal armature plate forming a portion of a circle and having its ends provided with projections and with notches as wide at their inner portions as the widest portion of the projections and formed to interlock with the ends of a similar plate.

(1) 415,696. Coil Guard for Armatures; (2) 415,697. Armature; Warren S. Belding, of Englewood, Assignor to the Belding Motor & Manufacturing Company, of Chicago, Ill. Applications filed (1) July 7, 1888. (2) Dec. 11, 1888. In an armature, the combination with the core, of coil guards applied to the ends of the core, the guards having lobes and a web connecting the lobes, and a tongue for securing the guard to the core. (2) In an armature, core sections meeting end to end and constituting the ring, and having their ends provided with interlocking notches and projections, the notches being as wide at their outer portion as the widest portion of the projections.

415,700. Telephone Receiver; James W. Bonta, of Philadelphia, Pa., Application filed March 20, 1889. A magnet having a disc core which serves as the spool for the magnet, and which has a number of poles at its circumference and at its centre at both ends of the spool, the outer surfaces of the poles on both ends of the spool being in the same plane for contact for the diaphragm at its rim and at its centre.

415,710. Separable Electric Conductor for Railway Gates; Frank E. Fowler, of Lynn, Mass., Assignor of one-half to Henry A. Marks, of same place. Application filed Aug. 1, 1889. Separable conductors for railway gates, consisting, essentially, of a post or posts placed behind the railway gates, the posts being provided with arms extending in a parallel direction with the gates, and the arms provided with spring actuated buffers connecting with the electric circuit and adapted to the passage of the gates between them.

(1) 415,747 (2) 415,748. Electric Meter; Elihu Thomson, of Lynn, Mass. Applications filed (1) April 8, 1889, and (2) Aug. 5, 1889. In an electric meter or motive device, the combination of an oscillating structure carrying two separate shiftable oversetting weights and separate expansible bodies for each weight, the bodies acting on the weights separately in opposition to a suitable retracting influence independent of the other expansible body. (2) The invention consists, essentially, in varying the



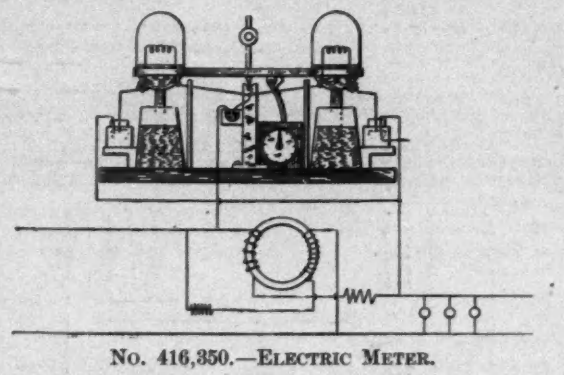
No. 416,604.—ELECTRIC METER.

height of the centre of gravity of the structure with the variations in the strength of current operating on the apparatus. Thus, for instance, in the case of an ordinary meter the centre of gravity of the structure would be raised as the current increased, thus requiring a greater proportional strength of current to overset or produce an oscillation or movement of the structure from one position to the other than is required with a smaller current, thereby compensating for the tendency to an increase in the proportions of oscillations when the current to be measured increases.

415,749. Electric Transformer; Elihu Thomson, of Lynn, Mass. Application filed Sept. 2, 1889. The invention consists, essentially, in making the iron core and envelope in four parts divided in two planes transverse to one another, and passing, respectively, through the coil in the general direction of its magnetic axis and in a direction transverse to such axis. See illustration.

415,751. Joint for Coupling Underground Cables; Bror Hemming Wesslau and Georg Trautwein, of Charlottenburg, Prussia, Assignors to Siemens & Halske, of Berlin, Germany. Application filed Feb. 4, 1887. Patented in Germany, April 27, 1887; in England, Sept. 2, 1887; in France, Dec. 20, 1887, and in Austria-Hungary, Feb. 18, 1888. In a coupling for cables having a concentric wire conductor wound around a layer of insulating material, the combination of two flanged tubes, one of the tubes being shoved upon the conductor and the other upon the insulating material, means for drawing the flanges thereon together, and a clamping screw adapted to receive a conductor.

415,752. Joint for Coupling Underground Wires; Bror Hemming Wesslau, of Charlottenburg, Prussia, Assignor to Siemens & Halske, of Berlin, Germany. Application filed Feb. 4, 1887. Patented in England, Sept. 2, 1887; in Germany, April 27, 1887; in France, Dec. 20, 1887, and in Austria-Hungary, Feb. 18,



No. 416,350.—ELECTRIC METER.

1888. An end closure for cables, consisting of a rubber hose, band, or insulating tape inclosing and in contact with the several layers of which the cable is composed.

415,765. Circuit for Multiple Switchboards; John J. Carty, of Cambridge, Mass., Assignor to the Western Electric Company, of Chicago, Ill. Application filed June 1, 1885. In a telephone exchange the combination, with the telephone lines, each extending to two or more switchboards, of test circuits, one test circuit for each line, each test circuit extending to all the boards and being permanently insulated from its telephone line, a source of electricity included in a grounded branch connected with the strand of each of the pairs of cords, which strand connects the sleeves of the terminal plugs thereof at each board, and switching apparatus for connecting the test circuit of any line automatically with the local battery circuit when connection is made with the telephone line at either board. See illustration.

415,766. System of Electrical Distribution by Secondary Batteries; Stanley C. C. Currie of Philadelphia, Pa., Assignor to the United Electric Improvement Company, of Gloucester City, N. J. Application filed March 8, 1889. In a system of electrical distribution, the combination, with a single electrical generator having its field magnets wrapped with a plural number of separate coils, a plural number of electric distributing devices, as storage batteries or the like, and a main line conductor, of a manually operated switch and an electrically operated switch appropriated to each separate coil of the generator, connected by a conductor, and so arranged that the movement of the manual switch will establish a circuit through the electrically operated switch, and thereby throw its group of accumulators and appropriate coil simultaneously into the main line circuit.

415,805. Lathe for Winding Armatures; Warren S. Belding of Englewood, Assignor to the Belding Motor and Manufacturing Company, of Chicago Ill. Application filed July 5, 1889. This invention relates particularly to a lathe to be used for winding the coils upon the sections of sectional armatures for electric motors and dynamos.

415,817. Electrical Appliance for Winding Clocks; Frederic A. Lane, of New Haven, Conn., Assignor of one-half to Frank E. Morgan, of same place. Application filed March 5, 1889. The invention relates to an improvement in the adaptation of electricity to apply the power to drive clockwork for time or other purposes, the object being a simple device for automatically applying the power to maintain the clockwork in a constant, continuous or unlimited movement.

415,856. Electric Heating Apparatus; Charles E. Carpenter, of Minnesota, Assignor of four-sixths to F. W. Nevens and John W. Kelly, both of same place. Application filed Aug. 6, 1889. In an electric heating apparatus, the combination with the body and the heating surface plate thereof of an electrical resistance lying between the body and plate, a layer of electrical insulating non-heat-conducting material between the resistance and the body.

415,871. Electro-Automatic Valve; Mary A. Kissell, of Chicago, Ill., for herself and as executrix of Abraham S. Kissell, deceased. Application filed March 31, 1889. In an electro-automatic valve, the combination, with the valve and an actuating piston of greater area connected thereto, of an auxiliary valve to control the passage of a fluid under pressure, a pair of magnets whose armatures are connected to the auxiliary valve, and a switch comprising spring contacts connected in separate circuits, and an arm moved by the oscillations of the armature and adapted to engage the spring contacts alternately, whereby to direct the current through the magnets alternately to cause the reciprocation of the auxiliary valve.

415,915. Electrical Annunciator; Charles E. Lee, of Rochester, N. Y. Application filed May 14, 1888. In an annunciator, the combination with the magnet, its armature, and the detent operated thereby, of the pivoted segmental plate having a series of stops on its periphery, with which the detent engages, corresponding to the several circuits, an indicator mounted on the pivot of the plate, a series of contacts connected to the several circuits extending parallel with the plate, a contact plate located upon the face of the segmental plate with which the several contacts break contact in succession when the plate is moved, and a main circuit, including the contact plate and magnet.

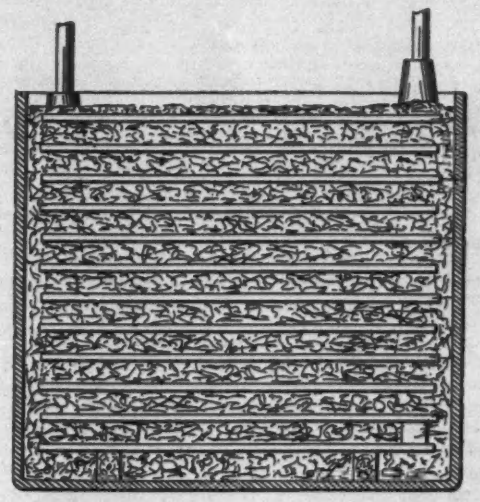
415,936. Electrode for Secondary Batteries; Joseph Y. Bradbury and Frank J. Stone, of Lowell, Mass. Application filed Sept. 13, 1889. An electrode for storage or secondary batteries, consisting of a suitable frame and ribbons or strips of conducting and supporting material alternately bent each over the other at about right angles and supported in the frame.

415,963. Galvanic Battery; Oscar A. Enholm, of New York, N. Y., Assignor of one-sixth to Ivar H. Enholm, of same place. Application filed April 19, 1889. The invention consists in the combination of a battery jar for holding chemical solutions with a dense partition or wall within it for separating two solutions, the partition or wall acting to prevent the passage of one solution into the other, while serving as a conductor between the solutions.

415,975. Galvanic Battery; Gustav Otto, of Jersey City, N. J. Application filed Aug. 1, 1889. A cell having the top closed by the material of which the cell is made and the lower end closed by an insulating plug or stopper extending into the cell from the lower end and held therein.

415,981. Secondary Battery; Walter F. Smith, of Philadelphia, Pa. Application filed Sept. 10, 1889. A battery plate or element provided with a divided supporting frame having loops which connect the sections or segments of the frame with each other.

415,990. Electric Trumpet; Jacques Paul Zigang, of Dumfront, France. Application filed March 27, 1889. Patented in France, Oct. 11, 1886. Instead of the ordinary circuit-changing bell or trembler, which is the alarm commonly employed in such signaling, an alarm or signaling instrument is employed at the distant station in which there is a vibratory plate supported at opposite edges and provided with a magnetic part in the field of the magnet, so as to be thrown into rapid synchronous movements



No. 416,299.—SECONDARY BATTERY.

under the successive attractions of an electro-magnet and produce a musical sound.

416,006. Induction-Telemeter; Paul Moennich, of Gehlsdorf, near Rostock, Mecklenberg-Schwerin, Germany. Application filed Sept. 30, 1886. Patented in Germany Aug. 11, 1887. For description see page 368, last issue.

416,013. Dynamo-Electric Machine or Motor; Andrew L. Riker, of New York, N. Y. Application filed July 9, 1889. In a dynamo or motor, the combination of the base in two parts, the pole pieces each integral with one of the parts, the base and pole pieces being recessed, as indicated, and a core and coil inclosed in the recess. See illustration.

416,051. Incandescent Lamp Socket; Paul J. Chassagne, of Akron, O., Assignor of one-half to S. Samuel Miller and William R. Palmer, of same place. Application filed March 28, 1889. The objects of the invention are to provide a socket for incandescent or electric lamps in which the endwise moving rod which makes connection with one of the poles is provided with a spring upon its lower end, which serves as a conductor from the rod to the lamp, and to prevent the rod from slipping after it has made connection with the pole, and to prevent the current from being broken if the lamp is turned by a careless person, and to

provide a short circuit which will prevent the lamp from being injured or destroyed in case one of the lamps is broken.

416,103. Electric Lock; Gustav A. Harter, of Chicago, Ill., Assignor to the Underwriters' Hatch Door Company, of same place. Application filed Dec. 4, 1888. In an electric lock the combination, with an electric magnet, of a bolt or detent under stress and an electrical switch, the switch being adapted to break an electrical connection with the electro-magnet and close the same with another circuit adapted to extend the circuit by the operation of the bolt.

416,122. Insulating Hanger; William B. Park, of Philadelphia, Pa., Assignor of one-half to Charles W. Ledig, of same place. Application filed October 14, 1889. The combination, in a hanger for electric wires, of a block having an elastic tongue with a strap adapted to be passed around an electric wire, and a device for securing the strap to the block and compressing the tongue.

416,126. Method of Making Supports for Electrodes of Secondary Batteries; Walter F. Smith, of Philadelphia, Pa., Assignor to the Electric Storage Battery Company, of Gloucester City, N. J. Application filed Sept. 10, 1889. For description see p. 369, last issue.

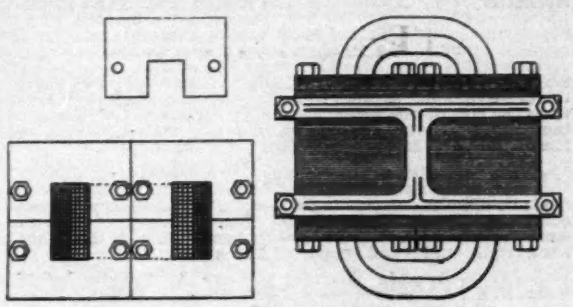
416,143. Coupling for Underground Cables; Bror Hemming Wesslau, of Charlottenburg, Prussia, Germany. Application filed Dec. 29, 1888. atented in Germany, April 27, 1887; in England, Sept. 2, 1887; in France, Dec. 20, 1887, and in Austria-Hungary, Feb. 18, 1888. In a connector for underground cables, the combination with the box constructed of two halves having a corresponding groove and flange, the upper half thereof forming a dome, and having a screw-hole in the upper part thereof, of metallic blocks having grooves therein for receiving the cables and contained within the box blocks for connecting test wires, also contained within the box, the remaining space therein being filled with liquid insulating material, and a screw plug fitting into the screw-hole in the dome of the box.

416,144. Coupling for Underground Cables; Bror Hemming, Wesslau, of Charlotteburg, Prussia, Germany. Application filed Dec. 29, 1888. Patented in Germany, April 27, 1887; in England, Sept. 2, 1887; in France, Dec. 20, 1887, and in Austria-Hungary, Feb. 18, 1888. In an electrical connector, the combination of a metallic tube having a solid end and a binding screw held thereby, an insulating block inserted in the tube, and a binding screw inserted in the block, whereby an electrical connection may be made by the main cable and a test wire contained therein.

416,148. Secondary Electric Clock; Eason L. Slocum, of Pawtucket, R. I. Application filed Oct. 26, 1888. The object of the improvement is to provide an electric chronometer having a device constructed for driving and locking a cheap and simple mechanism, which can be run, if necessary, by a single battery cell, insuring an absolutely correct action with a comparatively weak current of electricity.

PATENTS ISSUED DEC. 3, 1889.

416,169. Regulator for Electric Motors; Nathaniel Shepard Keith, of San Francisco, Cal. Application filed Dec. 24, 1888. In an electric motor, a governor of its speed, which consists of the following parts: A rotary disc or drum, gripping weights on the disc or drum and movable radially to and from, in obedience to centrifugal and centripetal



No. 415,749.—Electric Transformer.

forces, a rotatable cylinder concentric with the periphery of the disc or drum and gripped by the gripping weights more or less tightly under variations in the speed of rotation of the disc, or drum, brushes impinging or bearing on the commutator of the electric motor and attached to the rotatable cylinder, and a spring or counterbalance attached to the rotatable cylinder and opposing the rotation of the rotatable cylinder by the gripping weights.

416,191. Electro-Magnetic Motor; (2). 416,192. Method of Operating Electro-Magnetic Motors; Nikola Tesla, of New York, N. Y., assignor to the Tesla Electric Company, of same place. Applications filed May 20, 1889. (1). In an alternating current motor, the combination, with field circuits of different self-inductive capacity, of corresponding armature circuits electrically connected therewith. (2). The method of operating alternating current motors having independent energizing circuits, which consists in short circuiting the armature circuit or circuits until the motor has reached or passed a synchronizing speed, and then connecting the armature circuits with the external circuit.

(1) 416,193. Electro-Magnetic Motor; (2) 416,194. Electric Motor; (3) 416,195. Electro-Magnetic Motor; Nikola Tesla, of New York, N. Y., Assignor to the Tesla Electric Co., of same place. Applications filed May 20, 1889. For description of (1) see page 382; (2) page 382; (3) In an alternating current motor, the combination, with an armature wound with closed coils, of main and supplemental field magnets or poles, one set of which is adapted to exhibit their maximum magnetic effect simultaneously with that set up in the armature by the action of the other.

(1) 416,234. (2) 416,235. Distributing Box for Electrical Conduits; Edward S. Perot, of New York, N. Y. Applications filed June 29, 1889. (1) In a conduit system a distributing box provided with an artificial bottom molded into shape from some plastic material, and having troughs or channels on its upper surface in line with the openings in the main ducts. (2) In an electrical conduit system a distributing device consisting of the main tube or pipe having a portion of the same removed, and a box or chamber for covering the opening in the pipe, and provided with a detachable cover and side outlets for branch wires.

416,240. Electric Machine; Albert Schmid, of Allegheny, Assignor, to the Westinghouse Electric Company, of Pittsburgh, Pa. Application filed April 3, 1889. A field magnet for electric machines, consisting of two sets of laminæ semi-circular in form and a divided field magnet frame, one portion receiving one set of the laminæ and the other the other set of the laminæ.

416,275. Test Circuit for Multiple Switch Board; Charles E. Scribner, of Chicago, Ill., Assignor to the Western Electric Company, of same place. Application filed June 1, 1888. In a telephone exchange system, two or more switch boards to each of which the same telephone lines are connected, a portion of the telephone lines being metallic circuits and a portion single line circuits, the metallic circuits being respectively provided with a ground connection at the subscriber's station, and the single wire circuits being each provided with a grounded test circuit, the grounded test circuit of each of the different single line circuits and the return wire or limb of the different metallic circuits being balanced with respect to resistance.

416,284. Connector for Railway Conductors; Thomas E. Adams, of Cleveland, O. Application filed Oct. 11, 1889. A tubular connector formed with tapered ends and constructed with elongated recesses on one side and with set screws opposite the recesses.

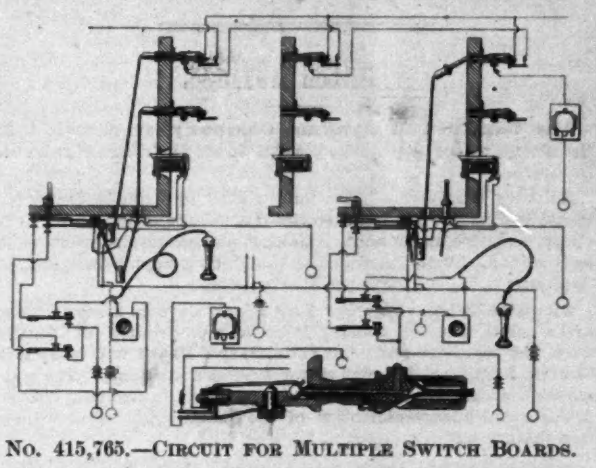
416,288. Binding-Post; Patrick B. Delany, of New York, N. Y. Application filed Oct 17, 1889. A binding-post having a transverse bore for the wire, a longitudinal screw-threaded socket for the clamping screw, a headed projection or pin secured to the under side of the screw head, and a wall or shoulder on the outside of the binding-post, against which the head of the pin abuts to prevent the withdrawal of the screw from its socket.

416,289. Appliance for Insulating Electric Wires; Augustus E. Ellinwood, of Akron, Ohio. Application filed Dec. 13, 1888. An improved insulator intersecting electric wires, consisting of a non-conducting frame adapted to receive and cross the wires unbroken and having the bearing surface for the trolleys in the same plane with the wires.

416,299. Secondary Battery; James K. Pumpelly, of Chicago, Ill., Assignor to Frank D. Thomason, of same place. Application filed July 27, 1889. The combination, with an electric battery, of an electrolyte, consisting of cellulose made from fibre saturated with electrolytic fluid. See illustration.

416,339. Compensating Electric Meter; Hermann Lemp, of Lynn, Mass., Assignor to the Thomson-Houston Electric Company of Connecticut. Application filed Sept. 24, 1889. The invention consists, essentially, in determining the action of the meter, or operating it in accordance with the resultant magnetic or electric effect produced by currents flowing in the intermediate wire between two groups of translating devices and an outside wire or wires of the group.

416,350. Electric Meter; Elihu Thomson, of Lynn, Mass. Application filed April 8, 1889. The invention consists, essentially, in employing the tension of a confined body of air, gas, or vapor, heated or put under tension by the heating effect of an electric current, as the direct force which imparts movement to the movable structure, which effect is accomplished by confining the gas or vapor in an inverted receptacle or chamber of any form carried



No. 415,765.—Circuit for Multiple Switch Boards.

by a movable support and dipping at its open lower end into a body of liquid which confines the gas or vapor in the receptacle under tension, leaving the chamber free to be raised by increased vapor tension against an opposing or balancing force whenever properly heated by the electric current.

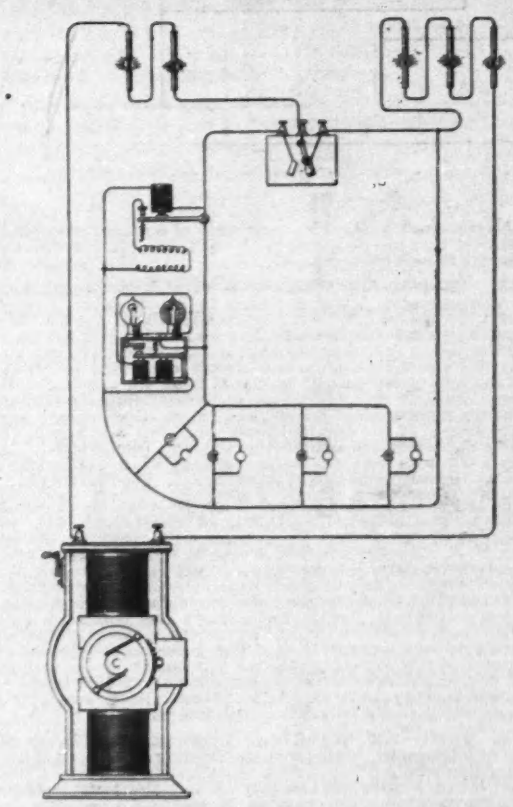
416,360. Electric Heating Apparatus; Mark W. Dewey, of Syracuse, N. Y., Assignor to the Dewey Corporation, of same place. Application filed Sept. 18, 1889. An electric heating apparatus consisting of a suitable source of electricity, two or more floor mats, comprising one or more heat-developing electric conductors detachably connected to the source of electricity, and a detachable electric connection between the mats.

416,366. Hinged Pan for Protecting Electric Motors for Cars; Tom L. Johnson, of Cleveland, Ohio. Application filed July 29, 1889. The combination, with an electric motor car, of a hinged pan adapted to protect the bottom, sides and ends of of the motor, and a suitable device for detachably securing the free end of the pan in its elevated position.

416,381. Electric Alarms; Robert D. O. Smith, of Mishawaka, Ind. Application filed July 5, 1889. An automatic electrical tell-tale for rope transmissions and the like, consisting of a pivoted arm or its equivalent placed in front of and close to the face of the pulley, a battery circuit and an electrical alarm in the circuit, and a circuit closer actuated by the arm, whereby when the same is engaged by any object moving with the rope, the circuit will be closed and the alarm sounded.

416,406. Electric Railway Signal; Frederick Wm. Frith, of Lennoxville, Quebec, Canada. Application filed March 27, 1889. The invention relates to that class of signals in which the signal board is operated by an electro-magnet.

416,443. Magneto-Electric Machine; William H. Cooley, of Brockport, Assignor of fifty-one one-hundredths to J. P. Dudley, Jewett M. Richmond and Wm. H. H. Newman, all of Buffalo, N. Y. Application filed March 5, 1881. In a magneto-electric machine, the armature composed of two concentric hollow cylinders of magnetic substance having longitudinal ribs formed thereon,



No. 416,611.—System of Arc and Incandescent Lighting.

substantially as shown, the cylinders being separated from each other by a diamagnetic non-conducting substance wound with insulated wire and supported from a central axis.

416,444. Auxiliary Fire Alarm System; Thomas Cooper, of New York, N. Y. Application filed March 11, 1889. The invention consists in devices, whereby each of the auxiliary stations in any one circuit is adapted to directly notify the engine house at which the circuit centers of the fact of the fire-call, the precise location of the same in the district, and at same time the general fire alarm circuit of the city has the same signal indicating the district sent to all the engine houses which are on the general circuit.

416,476. Telephone; Edward H. Lyon, of Needham, Mass. Application filed Sept. 23, 1889. The combination, with the diaphragm, of a heavy frame pivoted from beneath carrying the two electrodes, a finely divided conducting material, and a spring tending to separate the electrodes.

416,483. Auxiliary Fire Alarm; John P. McMahon, of Buffalo, N. Y., Assignor to the McMahon Thermograph Company, of Jersey City, N. J. Application filed Sept. 28, 1889. The system consists mainly of the following parts: First, a suitable battery which is included in a normally closed metallic circuit, and with which is combined a normally open-grounded circuit on the same wire; second, a relay or other usual and suitable receiving instrument on each circuit for receiving and recording signals; third, a signal box and indicator located at the building to b protected; fourth, thermostatic circuit controllers; fifth, the system of wires connecting the thermostats with the signal box and with a central office.

416,513. Fire-Alarm System; John Speicher, of Jersey City, Assignor by direct and mesne assignments to the Newark District Telegraph Company, of Newark, N. J. Application filed Oct. 10, 1888. The object of this invention is to provide a fire-alarm system in which boxes inclosing circuit breaking or closing mechanisms adapted to be manipulated by hand to produce an alarm, and for the special use of private families, factories, and the like, can be applied to and employed with the ordinary district boxes and mechanisms thereon on the main circuits under the care or control of the city, without detriment to the main circuits and district boxes, or in any way interfering with their ordinary working and without danger of producing a false alarm.

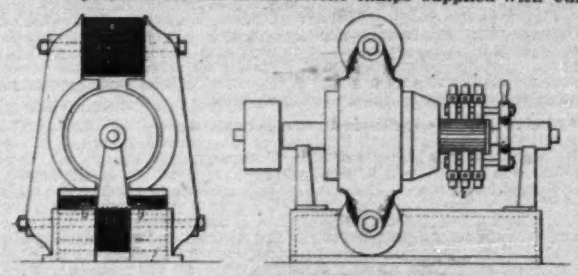
416,572. Electrical Signal Apparatus; Gustav Wilhelm Maximilian Conz, of Ulm, Wurtemburg, Germany. Application filed Oct. 5, 1887. Patented in Germany, Jan. 18, 1887; in Italy, May 26, 1887; in England, June 1, 1887; in Spain, June 3, 1887, and in Austria-Hungary, May 4, 1888. The invention consists in the combination, with a series of wires arranged concentrically, and each connected with a line wire, of a rotative contact closing arm, the centre of rotation of which is at the centre of the concentric wires, the arm serving to bring the line wire connected with it in circuit with one or more of the concentric wires, according to the signal to be sent.

416,573. Secondary Battery; D'Estaing S. Covert and James K. Pumpelly, of Chicago, Ill., said Pumpelly Assignor to said Covert. Application filed March 15, 1889. The improvement consists in the use of asbestos or any other fibrous absorbent non metallic and inoxidizable material as a support for the oxides or active material. On the surface of this is placed a mold constructed with narrow longitudinal channels across the face of the asbestos plate and around the rim of it, and through this is poured melted lead or lead alloys, which, opposite the channels, enters the pores of the fabric and becomes integral with it, forming also raised ridges on the surface. The lead ducts or conductors are so constructed as to all join together at the lug upon one side of the plate and serve as electrical conductors.

416,604. Electric Meter; Mads L. Hansen, of Bridgeport, Conn., Assignor of one-half to Frank Armstrong, of same place. Application filed April 23, 1889. An instrument for registering the time that an electric current is used, consisting of a movable hub carrying the ends of distributing and incoming wires, a short circuit wire, and a tube, a frame having a collar provided with openings which is mounted on the hub, and receptacles carried by the frame and provided with necks which register with the openings so that when the tube is in line with the openings the sand in the upper receptacle will pass through the tube into the lower receptacle. See illustration.

416,605. Secondary Battery; Thomas Joseph Haslam, Jr., of Dublin, Ireland. Application filed Oct. 5, 1889. Patented in England March 25, 1889. In a storage battery, a skeleton frame having its side rails provided with distance pieces and its top and bottom rails grooved for holding rods, pencils, spheres or beads of active material

416,611. System of Arc and Incandescent Electric Lighting; William Hochhausen, of New York, N. Y., Assignor to the Excelsior Electric Company, of same place. Application filed Aug. 6, 1883. The invention consists in the combination, with a system of arc and incandescent lamps supplied with cur-



No. 416,013.—Dynamo Electric Machine or Motor.

rent from a machine provided with an automatic current regulator, of an electro-magnet of high resistance arranged in a branch around the system of incandescent lamps in multiple arc and a normally open auxiliary branch controlled by the electro-magnet and containing a resistance. See illustration.

416,612. System of Arc and Incandescent Electric Lighting; William Hochhausen, of New York, N. Y., Assignor to the Excelsior Electric Company, of same place. Application filed Jan. 11, 1884. The invention consists, principally, in combining with the incandescent lamps arranged in multiple arc a spring or equivalently actuated shunting switch, the switch being normally (or while the lamps are working properly) held out of operation by a catch or detent and automatically released by any suitable means, as by an electro-magnet, upon an abnormal flow of current in a multiple arc branch which branch may be a branch containing a lamp, but is preferably a separate branch containing a high resistance magnet.

416,632. Incandescent Electric Lamp; Luther H. Leber, of York, Assignor of one-half to George B. Anderson, of Pittsburgh, Pa. Application filed July 10, 1889. In an incandescent lamp, the combination, with the customary exhausted globe, of an independent socket adapted to be removably connected with the globe, a pair of resistance coils contained within the socket and having exposed lower portions of insulating material, one of the coils being, through the medium of the light wire, in contact with the negative pole, and the other coil in direct contact with the positive pole, insulated discs connected, respectively, with the upper and lower ends of the coils, a slide having bearing within the socket and connecting the coils, and a key adapted to reciprocate the coil connecting slide along the coils for the purpose of regulating the flow of the electric current to the light wire and regulating the intensity of the light.

416,635. Gas-Lighting System; Adam Lungen, of New York, N. Y. Application filed Feb. 12, 1889. Claim. In a multiple arc or multiple series system of electrical distribution for igniting gas at the burners, the combination, with a burner or burners located in the cross branches of the circuit, of a condenser located in each of the branches.

(1) 416,654. (2) 416,655. Galvanometer; William Thomson, of Glasgow, County of Lanark, Scotland. (1) Application filed Dec. 8, 1887. Patented in England July 10, 1886; in France, May 23, 1887, and in Belgium, May 25, 1887. (2) Application filed June 4, 1889. The apparatus is an electro-dynamic balance consisting, essentially, of a soft-iron core or movable coil made temporarily magnetic by the current to be used by means of a fixed coil or coils through which the current temporarily passes. For a standard instrument not liable to change with time, a movable coil or coils mounted on a gravity balance and affected by corresponding fixed coil or coils and special arrangments for putting on or taking off weights is preferred. (2) The improvement consists, essentially, of a magnetic needle carrying an indicator needle and supported so as to hang in the centre of the magnetic field of a double electro-magnetic coil, and adjustable permanent magnets placed along the circumference of two horizontal circles having their axes coincident with the axis of the magnetic needle for the purpose of influencing the position of the needle.

416,662. Friction Generator; Samuel H. Bartlett, of New York, N. Y. Application filed June 7, 1889. In a friction generator, the combination, with a frame or case, of a rod mounted in the case, a collar, mounted on the rod, a hub mounted on the collar carrying a plate, another hub loosely mounted on the rod, and intermediate gear between the hubs, whereby the plates are rotated in opposite directions.

PATENT EXPIRING DEC. 3, 1889.

133,595. Insulation of Telegraph Lines; Henry J. Rogers, of New York, N. Y. A sub cross bar provided with an insulator and supported upon the main cross bar by other insulators.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address The W. J. Johnston Co. Ltd., Times Building, N. Y.